A CRITICAL APPRAISAL OF MICROFINANCE INSTITUTIONS IN INDIA: A CASE STUDY OF SEEMANDHRA (ANDHRA PRADESH)

THESIS

SUBMITTED FOR THE AWARD OF THE DEGREE OF

Doctor of Philosophy
In
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BY

KASHIF BEG

UNDER THE SUPERVISION OF CHAIRMAN

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DEPARTMENT OF COMMERCE
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ALIGARH (INDIA)

2016

Dedicated
To My
Beloved Parents

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acknowledgement

In the name of ALLAH, the Most Gracious, the Most Merciful.

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(Kashif Beg)

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LIST OF ACRONYMS

ALBPB	Average Loan Balance per Borrower
ALBPBG	Average loan balance per borrower adjusted by GNI per capita
AML	Asmitha Microfinance Limited
AROA	Adjusted Return on Asset
CCTA	Capital cost to total assets ratio
CGAP	Consultative Group to Assist the Poor
DW	Durbin Watson
FSS	Financial Self-Sufficiency
GLPTA	Gross loan portfolio to total assets ratio
HAC	Heteroscedasticity and autocorrelation consistent
JLG	Joint Liability Group
L_ASS	Log of Assets
M-CRIL	Micro-Credit Rating International Limited
MF	Microfinance
MFI	Microfinance Institution
MIX	Microfinance Information Exchange
NPA	Non-Performing Assets
OSS	Operational self sufficiency
P30	Portfolio at risk (30) days
POFB	Percentage of female borrowers
SHG	Self Help Group
YOGP	Yield on gross loan portfolio

1.1 INTRODUCTION

Microfinance institutions (MFIs) have proved to be very important in the growth and development of a country. MFIs enhance financial deepening in an economy thereby contributing to an economy's development by providing financial services to the extremely poor section of society. Nowadays, MFIs face the challenge of sustainability and outreach. There has been increased pressure on MFIs to decrease dependence on donations, grants and subsidized funding. As providing Microfinance services is a costly business due to high transaction and information cost. At present, large number of Microfinance programs still depend on donors, grants and donations which mean that MFIs are not financially sustainable. In the 1990s, the issue of sustainability of MFIs gave rise to an important debate between financial system approach and poverty lending approach (Robinson, 2001). According to the report of Deutsche bank (2007), only 1-2% of MFIs in the world are financially sustainable. 8% of all MFIs are close to being profitable. 70% of all MFIs are heavily dependent on subsidy. However, proponents of poverty lending approach claim that focusing on financial viability goes at the cost of lending to the poor. Lending to the poor involves very high cost which means that outreach and sustainability goals are conflicting. Hence the issue of tradeoff between sustainability and outreach requires empirical enquiry.

Microfinance in India has grown at tremendous pace in recent years, achieving significant outreach amongst the poor household across the country. According to the status of Microfinance report (2011-12), there are about 1,000 MFIs in the country working in various legal forms. The southern state of Andhra Pradesh accounts for about 30% of the credit extended by MFIs. According to the article published in "Business Standard" the number of Self-help groups are declining over the years an indication of weakening SHG movement in India. NABARD has also raised alarm over rising Non-Performing Assets (NPAs) or Bad loans in SHG bank linkage model. According to the status of Microfinance report 2011-12 in India, the gross nonperforming assets of SHGs increased from 4.72% as on March 2011 to 6.09% as on March 2012. Andhra Pradesh Microfinance crisis leads to the following repercussions that Non-Performing Assets (NPAs) of Andhra's MFIs were at an all-time high of over 96% in the year 2011. Smaller emerging MFIs shut down their business operations and loss of MFI portfolio to the extent of Rs 7,200 crore. This is a

matter of concern for Microfinance sector and the causes of declining recovery rate to be analyzed. Therefore the important issue of sustainability, outreach and rising Non-Performing Assets (NPAs) has been covered in this study. This study is meant to determine the factors affecting operational sustainability, financial sustainability, loan delinquencies and outreach to poor and women clients and the tradeoff between sustainability and outreach in the context of Andhra Pradesh MFIs.

1.2 STATEMENT OF THE RESEARCH PROBLEM

This study focuses on determining the factors affecting the operational sustainability, financial sustainability, loan delinquencies, outreach to poor and women clients and moreover to determine the tradeoff between outreach and sustainability i.e. Mission Drift in the context of Andhra Pradesh MFIs. India's Microfinance sector is rated as one of the fastest growing Microfinance sector in the world. Poverty alleviation is one of the prime objectives for growth and development of a country. MFIs play a significant role in alleviating poverty where the poor or unprivileged have limited access to financial services to financial services provisions. Because of this and other important social missions, they have attracted the attentions of donors or institutions which have missions to end poverty in the world. Microfinance institutions are constrained to achieve double objective of self-sustainable i.e. covering enough cost so that reliance on subsidy can be overcome and serving unreached poor clients with financial services (outreach). As the Microfinance sector grows in size, the need for increased financing coupled with unpredictability of subsidized or donor fund gave birth to the issue of building sustainable MFIs which can cover their own cost of operation from program revenues in order to provide financial services for longer period of time without compromising with outreach to poor and women clients. Outreach of MFIs is viewed as a social performance. It is defined as the ability of an MFI to provide high-quality financial services to a large number of clients (González-Vega, 1998). According to Schreiner (2002) outreach is "a social benefit of microfinance" aiming at improving the well-being of the poor. Microfinance Institutions performance is measured from both sustainability and outreach point of view by using Proxies for sustainability and outreach. Furthermore, the latest concern of rising Non-Performing Assets (NPA's) in microfinance schemes has also been investigated.

India's Microfinance sector is rated as one of the fastest growing sector in the world. The state of Andhra Pradesh is considered as Mecca of Microfinance. The state of Andhra Pradesh experienced the steepest decline in rural poverty rates and attained lowest poverty rates in recent years. According to the status of Microfinance report, 2007 poverty declined from 29.75% to 10.85% in 2004-05. But the scenario changed in the year 2010, Microfinance sector affected badly by Microfinance Crisis 2010. Andhra's MFIs came under the scanner of authorities after reports of suicides due to alleged coercive recovery methods adopted by MFIs. The Andhra Pradesh government enacted the law in October 2010 to regulate microfinance lenders. Before the crisis, Andhra Pradesh was the biggest state for microfinance, accounting for more than one-fourth of total assets of the industry. According to the status of Microfinance report 2011-12 after the crisis, Andhra Pradesh is now home to about 6,000 crores of bad loans. The Andhra Act 2010 led to slumping in recoveries and halt in bank funding to the sector.

In order to determine MFIs are able to meet the challenge of sustainability and outreach to poor and women clients, there is no other alternative but to assess the performance of MFIs. The biggest challenge for MFIs is how to attain financial sustainability without compromising with outreach to poor and women clients (Dunford, 2003; Schreiner, 2000). The problem has attracted numerous researchers in last two decades and as a result, various new ways have been adopted to make MFIs sustainable (Yaron, 1992; Schreiner, 2,000). Several studies have been conducted to determine factors affecting the sustainability of MFIs (Cull, Demirgüç-Kunt & Morduch, 2007; Nyamsogoro, 2010; Adongo and Stork, 2005; Ayayi and Sene, 2010; Bogan, 2012; Woller & Schreiner, 2002; Woldeyes, 2012; Rahman and Mazlan, 2014). Very few studies focus on sustainability issue of Indian MFIs i.e. (De Crombrugghe, Tenikue, & Sureda, 2008; Nadiya, 2011; Gakhar, 2013). The issue of tradeoff between sustainability and outreach has been empirically analyzed by Coleman & Osei, 2008; Cull *et. al*. 2008; Cull *et. al.*, 2007; Hartarska & Nadolnyak, 2007; Kar, 2010; Woller and Schreiner, 2002. Another major concern in the field of Microfinance is of loan delinquencies. The issue of factors affecting loan repayment performance has been analyzed by (Crabb & Keller, 2006; Cull *et. al*., 2007; Assefa, Hermes & Meesters, 2013; Bassem, 2013). Most of the literature in the field of Microfinance focuses on the impact of Microfinance on Poverty eradication, Women

empowerment, Income and standard of Living. Keeping in view the dearth of empirical literature focusing on the issue of sustainability, outreach, loan repayment performance and the tradeoff between sustainability and outreach and also keeping in view the lack of research conducted on Andhra Pradesh MFIs which is known for Microfinance sector in India. The focus of this study to bridge out the gap by examining the determinants of sustainability, outreach to poor and women, Loan delinquencies and tradeoff between sustainability and outreach.

1.3 OBJECTIVES OF THE STUDY

The main objective of this study is to determine factors affecting sustainability, outreach, loan repayment performance and evidence of Mission Drift for Andhra MFIs. In the light of the main objective, this study has specifically tried to address following specific objectives.

(1.3.1) To find the determinants of Operational and Financial sustainability of MFIs in Andhra Pradesh.

(1.3.2) To determine the effects of MFIs outreach and other related factors on the financial sustainability and operational sustainability of MFIs in Andhra Pradesh.

(1.3.3) To examine the causes of loan default/delinquency of Microfinance institutions in Andhra Pradesh.

(1.3.4) To find out the tradeoff between sustainability and outreach of MFIs in Andhra Pradesh.

(1.3.5) To analyse the effect of increasing interest rates on loan delinquencies.

(1.3.6) To determine the effect of increasing interest rates on financial performance.

1.4 RESEARCH QUESTIONS

With the above research objectives in mind, this study was set forward to answer the following questions: what are the determinants of factors affecting sustainability, outreach, loan repayment performance and evidence of Mission Drift for Andhra Pradesh MFIs From this main question the following specific questions were addressed.

(1.4.1) What are the important factors or determinant of operational and financial sustainability of Andhra Pradesh MFIs?

(1.4.2) Does the microfinance financing structure; interest rates; minimum loan size; MFI age; MFI size; depth of outreach; gender of MFI clients; labour cost affect the operational and financial sustainability of MFIs in Andhra Pradesh?

(1.4.3) Does the interest rates; average loan balance; loan portfolio; labour cost; gender of MFIs clients; Age of MFIs; Size of MFIs affect loan repayment performance?

(1.4.4) What are the effects of financial sustainability on the breadth of outreach?

(1.4.5) What is the impact of increasing interest rates on loan repayment performance of Andhra Pradesh MFIs?

(1.4.6) What is the impact of increasing interest rates on the financial performance of Andhra Pradesh MFIs ?

1.5 SIGNIFICANCE OF THE STUDY

This study attempted to highlight the very important issue for Microfinance practitioners, researchers and policy makers. This study contributes to the knowledge of sustainability, outreach, mission drift and loan repayment performance of Andhra Pradesh MFIs which is known for Microfinance sector not only in India and but all over the world. In addition to the central concern of this study i.e. determining factors affecting operational sustainability, financial sustainability and outreach to poor and women clients. The study found strong evidence of tradeoff between sustainability and outreach i.e. Mission Drift. Secondly. The empirical findings revealed that Women clients are reliable borrower i.e. increasing share of women borrowers reduces loan delinquencies. Thirdly, the study found empirical evidence of increasing interest rates increases loan delinquencies. Fourth, MFIs with higher cost to assets provides smaller loan amount. Lastly, the study also discusses the implications of the conclusion made and identifies areas that need further research.

1.6 STRUCTURE OF THE THESIS

This thesis is divided into six chapters. The first chapter introduce about the research problem and also discussed the objectives of the study and main questions guiding the study. The remaining chapter are arranged as follows: Chapter two discusses about literature review and concept of this study; chapter 3 is about: An overview of trends and patterns of sustainability and outreach of MFIs in Andhra Pradesh; Chapter 4 highlights the research methodology used in this study; Chapter 5 discusses the results

and discussions; finally chapter 6 offers the conclusion and key contributions made in this study. It also highlights the areas for future research.

CONCLUSION

To conclude, it is found that the present chapter presents a broader outlook of the focal resolution for carrying out the present study by discussing the statement of the research problem along with research questions, objectives and significance of the study. The next chapter has been prepared for the discussion of the literature review specifically related to the research aspect of the study.

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2.1 INTRODUCTION

As the abundance of research work has been done in the field of Microfinance in the last two decades. Therefore, the study focus on the literature related to our research objectives. This research work deals with the issue of factors affecting operational self-sufficiency, financial self-sufficiency and loan repayment performance and the trade-off between financial performance and outreach to poor and women clients. Section first is about the introduction of this chapter. The second section deals with prior research work on factors affecting the sustainability of MFIs. Section third reviews prior research works on Mission drift i.e. trade-off between sustainability and outreach. Finally, section fourth deals with the factors affecting loan repayment performance.

2.2 SUSTAINABILITY

De Crombrugghe *et. al*. (2008) used regression to identify the factors affecting financial sustainability of microfinance institution in India. Cost average by revenue, repayment of loans and cost control are the three indicators used to study different aspects of sustainability. The study is based on database datasets of 42 MFIs for the year 2003 provided by SADHAN (A nonprofit microfinance coordination and analysis organization). The result suggests that challenge of cost covering on small and partly unsecured loan can be met without increasing the size of the loan. MFIs can achieve financial sustainability without compromising with outreach to poor. The empirical result revealed most of the MFIs are unable to cover their cost.

Schafer and Fukasawa (2011) in their paper titled, "Factors determining operational self-sufficiency among Microfinance institutions" investigate the factors affecting the operational self-sufficiency of MFIs. The empirical investigation is based on the data of 1,000 MFIs retrieved from MIX market for the year 2006 and 2008 scattered in different parts of the world. Their empirical findings by multiple regression analysis revealed that number of borrowers, write-off ratio were found to be important determinants of operational self-sufficiency. Moreover, there was no significant difference in 2006 before the worldwide financial crisis and in 2008.

Zerai & Rani (2012) examined technical efficiency of Ethiopian microfinance institution (MFIs) by utilising data from 19 microfinance institution taken from mix market with the help of stochastic frontier analysis. The findings of the study revealed

that average efficiency score of 71.72% of Ethiopian MFIs. Assets, operational sustainability, depth of outreach have significant impact on efficiency. The empirical findings confirm trade-off between efficiency & outreach of Ethiopian MFIs.

Cull, Demirgüç-Kunt & Morduch (2011) examines by using dataset of 245 microfinance Institution effect of prudential supervision on MFI profitably outreach to small-scale borrowers and women. Their finding suggests that profit oriented microfinance institution responds to supervision by maintaining profit rates & but at the cost outreach to women & poor client that are costly to reach. Their empirical finding shows that supervision has a negative effect on outreach because supervision is positively related with average loan balance while it is negatively related to the percentage of women borrowers.

Gutiérrez-Nieto, Serrano-Cinca & Molinero (2009) in their paper discussed the dual performance of MFIs i.e. social & financial performance. Out of data set of 450 institutions for the year 2003from mix microfinance information exchange, only 89 MFIs were selected for which complete information was available. Data envelopment analysis (DEA) was used to calculate the social & financial efficiency of MFIs. Operating cost and assets gross loan portfolio used as inputs. Gross loan portfolio & financial revenue are used as outputs for measuring financial efficiency. No. of active borrowers & indicator of benefit to the poorest are used as output variable to calculate social efficiency .The result of financial efficiency and social efficiency was correlated with various financial ratios to withdraw the result & interpretation. The findings of this paper suggest that except one, no MFIs are socially efficient but financially efficient MFIs exist. There is low positive relationship between the social & financial efficiency of MFIs.

Tehulu (2013) used unbalanced panel data from 2004 to 2009 of 23 microfinance institutions in east Africa to identify the factors affecting financial sustainability .the study used binary probit & ordinary probit regression models to identify the factors. The empirical result regression revealed that management efficiency & portfolio at risk is negative & significantly related with financial sustainability. Management inefficiency, portfolio at risk, loan intensity & size are important factors of financial sustainability.

Rai (2012) in his research work "A comparative analysis of the financial performance of microfinance institutions of India and Bangladesh" analysed the financial

performance of Indian MFIs and compared it MFIs of Bangladesh from different point of view by using various performance indicators & Ratios. Mann-Whitney U test is used to compare the financial performance of India & Bangladesh MFIs. Kruskal-Wallis one-way ANOVA is used to analyse age wise performance of Indian MFIs after categorising MFIs into young, mature & old. This study covers the period of 2007-08. There is no significant difference between the means of Bangladesh & Indian MFIs on operational self-sufficiency, yield on gross loan portfolio & return on assets. NBFC MFIs are financially more viable & outreach is high.

Masood & Ahmad (2010) measured the technical efficiency of microfinance institution by applying the stochastic frontier approach of unbalanced panel data of 40 microfinance institutions withdrawn from mix market for the period 2005-08. The objective of the study is to benchmark the best practice MFIs by assigning ranks & to determine the factors responsible for variation in efficiency level. The findings of the study revealed that efficiency level of microfinance institution is very low & it is increasing during the study period & there is no evidence of trade off. MFIs in the southern part of India are more efficient than other MFIs. Moreover, unregulated MFIs are more efficient than regulated MFIs.

Gutierrez-Nieto, Serrano-Cinca & Molinero (2007) employed data envelopment analysis (DEA) approach to efficiency to prove that ratio analysis does not capture DEA efficiency. This study highlights an important aspect that, "how DEA model is specified" i.e. which input & output variables should be chosen. A methodological approach based on multivariate analyses is applied in order to choose appropriate model specifications & to produce ranking of MFIs in terms of efficiency. The finding of the study is based on data obtained data of 30 MFIs from micro rate web page from the year 2003. The selection of inputs & outputs indicators is based on Yaron's (1994) outreach & sustainability framework. The study reveals that level of MFIs depends on the particular model. That model is also relevant for efficiency assessment .Their suggestion to the policy makers, analyst, rating agency & users to incorporate measures of efficiency based on DEA.

Martinez-Gonzalez (2008) examined the technical efficiency of microfinance institution by using DEA & also identify differences in efficiency with the help of Tobit regression average loan size, proportion of assets used as performing portfolio, scale of operation, ratio of payroll to expenses, age, structure of the board & for profit

status of MFIs are the indicators used to determine differences in efficiency. The empirical evidence shows the trade-off between sustainability & outreach in Mexican MFIs. Moreover, this study provides an idea how to use tools to analyse the relative technical efficiency of MFIs.

Hassan & Sanchez (2009) investigates about the technical & scale efficiency of MFIs by using Data elopement analysis. The data of 215 MFIs was taken from MIX market (A CGAP data base of MFIs around the globe). These MFIs are scattered in the region of Latin America, Middle East & North Africa & South Asia. The efficiency of MFIs is analysed following both production approach & intermediation approach. The inputs indicators for the intermediation approach are operating expenses, total financial expenses & labour. The indicators used as output in intermediation approach are gross loan portfolio, total funds & financial revenues. On the other hand, operating expenses & labour are used as input in production approach & Numbers of the active borrower is as the only input. The empirical findings of the study depict that technical efficiency is higher for formal MFIs. South Asian MFIs have higher efficiencies in comparison to Latin America & Middle East & North African MFIs. The efficiencies are of purely technical nature i.e. MFIs are wasting their resources & not producing enough outputs.

Nawaz, Hudon & Basharat (2011) in his research paper analyse the efficiency of microfinance institutions in Pakistan by taking data from Pakistan Micro Finance network for the year 2003 & 2007. The non-parametric mathematical programming approach (DEA) Data envelopment analysis has been used to analyse the efficiency of MFIs in delivering credit to poor section. The findings of DEA depicts that out of 12 there is three microfinance institution for the year 2003 FMFBL, SUNGI & TARAQEE are on efficient frontier and both constant return to scale & variable return to scale assumptions. In the year 2009 out of 19 only four i.e. POMFB, RMFB, NMFB & TF are efficient under both assumptions. Inefficient MFIs must enhance the managerial skills & improve technology.

Hudon & Traca (2011) in their paper study the impact of subsidy intensity on the efficiency of the microfinance institution. The data of financial statements gathered by two leading microfinance institution Planet rating & microfinance during the period 2002-05 of 100 MFIs were obtained. Efficiency tax which is used as a measure of subsidy intensity. They report that only 5% of total MFIs are operationally self-

sufficient. Their empirical finding by using cross section regression suggest that subsidies have a positive effect on efficiency but up to a certain limit. The effect of the subsidy on efficiency becomes negative above a threshold limit.25% of the total MFIs are found in this condition. Highlighting the effect of the subsidy on the effectiveness of MFIs is highly policy relevant because MFIs still receives subsidies & providers of microfinance increasingly demand transparency related to the subsidies on the performance of MFIs.

Qayyum and Ahmed (2006) in their research paper identify most efficient and sustainable MFIs by using DEA in the south Asian region. The study is based on data of 85 MFIs from mix market scattered in the region of Indian, Pakistan & Bangladesh .The technical efficiency of MFIs is calculated by applying both constant returns to scale & variable returns to scale .The findings of empirical evidence suggest that eight MFIs from Pakistan, six MFIs from Bangladesh & five MFIs from India are efficient under variable returns to scale. The combined analysis of three countries disclosed that two efficient MFIs under CRS & five MFIs are efficient under VRS. Technical natures of inefficiencies arise in three countries. The combined analysis of countries reveals that nineteen MFIs are efficient i.e. eight from Pakistan, six from Bangladesh & five from India.

Ferdousi (2013) analyses the efficiency of microfinance institution by using DEA in three Asian countries namely India, Pakistan & Bangladesh. The DEA has been applied under both assumption i.e. constant returns to scale and variable returns to scale. The data of 42 MFIs from china, 89 from India & 34 MFIs from Bangladesh has been withdrawn from mix market database. Operating expenses & number of staff have been used as indicator inputs. |While gross loan portfolio & number of active borrowers have been taken as output indicators. Best practice MFIs have been identified by applying DEA. The efficiency determinant also has been identified by using Tobit regression model. The finding of the study revealed that China's & India's MFIs are efficient or perform better than that of Bangladesh under both assumptions.

Sufian, Majid and Zulkhibri (2007) in their paper investigates the efficiency of finance & merchant banking institution during the post-consolidation period in Malaysia. By applying DEA methodology on data set 20 finance & merchant banking institution during the period 2000-2004 following combination of inter mediation

approach or assets approach. Total deposit & fixed assets are used as inputs indicator and total loans and other income is used as output indicators for determination the best practice frontier. The empirical result of the study suggests that pure technical efficiency is more related to overall efficiency than scale efficiency. Only 28.7% institutions are operating at CRS while most of the institutions are inefficient. The result of Tobit regression model suggests that efficiency is positive & significantly related with market share & bank capitalisation. Contrary to this, size and economic environment are negatively related with efficiency, overhead expenditure has a positive relationship but insignificant and degree of specialisation & bank efficiency is positively related to efficiency.

Tahir & Tahrim (2013) examined & compared the efficiency levels of five Asian countries namely Indonesia, Philippines, Vietnam, Cambodia & Laos. Data envelopment analysis with production approach is employed to determine efficiency .This study is based on four-year data for the year 2008 to 2011 withdrew from mix market. Total asset & operating expenses have been adopted as input while gross loan portfolio & number of active borrowers are used to measures output. The result depicts that Vietnam has the highest efficiency score (87.6%) followed by Cambodia (74.6%) Philippines (65.9%) & Loas have the lowest score of (45%). The pure technical efficiency is lower than the scale of efficiency for Indonesia, Cambodia, Philippines & Vietnam during the study period.

Wijesiri (2014) examined the technical efficiency of 86 microfinance institutions by applying an innovative two-stage double bootstrap approach. Financial efficiency & social efficiency is analysed by two different DEA models designed to measure DEA scores. The findings revealed that most of the MFIs are not financially & socially sustainable. The result of the regression analysis revealed that age & capital to assets has significant impact on financial efficiency. Moreover, age, return on assets and type of the institution have a significant impact on social efficiency.

Nghiem, Coelli & Rao (2006) analysed the efficiency of microfinance schemes of Vietnam by DEA, SFA and PLP approach. Labour cost and the non-labour cost is used as inputs variables. However, savers, number of borrowers and number of groups are used as output variables. Technical efficiency scores by DEA, SFA & PLP techniques are 76%, 69% and 78% respectively. Distance to the township,

environmental factors and maturity of scheme significantly affects the efficiency of schemes. Schemes operating in remote area more efficient than others.

Darko (2013) in his research paper determines the efficiency of MFIs by using DEA technique. This study also determined the factors influencing the efficiency of MFIs. The data of 273 Sub-Sahara Africa MFIs is extracted from MIX market database for the period 2005-2011 from 35 countries. Overall technical efficiency, scale efficiency and pure technical efficiency has been examined by DEA. The factors influencing OTE & PTE has been determined with the help of truncated regression model. The findings of the study revealed following production approach personnel expenses, administrative expenses & financial expenses are used as input indicator. The net loan is used as single output indicator. The findings of the empirical evidence suggest that technical efficiency during the sample period range 0.1003 to 1, with an average figure of 6288. Technical efficiency of MFIs is due to managerial efficiency. Scale efficiency is high among commercial MFIs. Overall technical efficiency & pure technical efficiency is positively related to the age of MFIs & commercialization of MFIs.

Singh (2014) used an innovative form of the DEA model with input replaced by control factors & output replaced by performance characteristics. This study is based on data of thirty microfinance institution withdrew from mix market. Equity & debt & portfolio at risk are used as control input indicator. While gross loan portfolio, outreach, operating profits and total revenue from gross loan portfolio are used as performance indicator. The result derived from empirical findings revealed that high level of efficiency with an average efficiency score of 63.5%. The control efficiency scores show higher level of efficiency. The study suggests that microfinance institutions has to bear more risk in order to achieve better financial performance & outreach.

Basharat, Hudon & Nawaz (2015) used DEA technique to analyze the financial & social efficiency. Tobit regression model is applied to identify the impact of MFI's social efficiency and financial efficiency. By using data sets of 291 MFIs located in 67 countries for four years (2005-2008) extracted from mix market (global database of MFIs). Total assets, operating cost and number of staff is used as input indicators for measuring financial efficiency. Gross loan portfolio and financial revenue are used as output indicator for measuring financial efficiency. Number of women borrowers

& benefit to the poorest is used as output indicators for the measuring social efficiency .The findings of the study revealed that financial efficiency is positively related to the interest rate. Financial efficient MFIs charge lower interest rate. Social efficiency has no relation with interest rate charged by MFIs

Tahir & Tahrim (2015) in their research paper employs DEA & Dynamic Malmquist Productivity Index (MPI) to determine the efficiency of Cambodia microfinance institution during the period 2008-2011. This study applied production approach of DEA on data of thirteen microfinance institution taken mix market. (A Global database of MFIs). Gross loan portfolio & number of active borrowers are used as output vectors. On the other hand, total assets & operating expenses are used as inputs vectors. The finding of the study revealed that overall efficiency microfinance of institution in Cambodia slightly has improved 91% in 2008 & 92% in 2009 & remain stable in 2010 & 2011. The technical change had been regularly influencing productivity change during the study period. After decomposing efficiency into technical and scale efficiency change both DEA & MPI indicates that dominant source of efficiency was scale related rather than technical efficiency.

Kinde (2012) used balanced panel dataset of 14 MFIs over the period 2002-2010 to identify factors affecting financial sustainability of MFIs. Their findings show that breadth of outreach, depth of outreach, dependency ratio and cost per borrower are the significant factors affecting financial sustainability of MFIs in Ethiopia. However, capital structure and staff productivity have an insignificant impact on financial sustainability.

Ali (2013) examined the relationship between financial sustainability and outreach by using data of financial statements and internal records of 30 MFIs that operate in Nairobi (Kenya). He concluded that branches diversification, no. of active borrowers and percentage of female borrowers influenced the financial sustainability of MFIs to greater extent. Average loan size contributes to increased depth of outreach. Moreover, there is strong relationship between financial sustainability and outreach.

2.3 MISSION DRIFT: TRADEOFF BETWEEN FINANCIAL PERFORMANCE AND OUTREACH

The contribution by **Mersland & Strom** (2010) examines the mission drift by using panel regression generalised method of movements for average loan & logistics

regression for other depth measures on the data set of 379 MFIs in 74 countries was collected by rating agencies during the years 1998-08. This study investigates about the mission proxy & lending methodology, main market & genders bias as further mission drift measures. Their empirical finding did not find any evidence of mission drift .The econometric evidence supports that average loan size increase with increase in average profits & average operational costs.

Gakhar (2013) in his empirical study of MFIs in Indian economy study the outreach and financial performance. This study analyses the data of 40 microfinance institutions taken from mix database for the period 2004 to 2011. The mix is a global database that provides data of that provide data of 1400 MFIs around the globe. The regression analysis model is used to identify a trade-off between outreach &financial performance. The empirical evidence suggests data increased the level of outreach improves financial performance .They conclude that MFIs can achieve dual objective of outreach & financial performance.

Kaur (2014) in her study titled "outreach & sustainability of MFIs in India in pre & post-Andhra Pradesh microfinance crisis in the context of south Asia highlighted various dimensions of sustainability & outreach of MFIs in south Asia. The study analysis the data for the year 2008 to 2011 of south Asian MFIs. Their finding suggests that OSS of MFIs is better than MFIs in Afghanistan & Pakistan. After Andhra crisis, cost per borrower has increased & it is lowest in India .Portfolio quality of Indian MFIs has also improved after the crisis.

Gashayie and Singh (2014) investigate the association between financial sustainability and outreach of Ethiopian MFIs by using data of 5 MFIs for the year 2011. Number of borrowers and average loan size adjusted by GNP per capita as proxies for measuring outreach. Their findings revealed that there is no significant relationship between outreach and financial sustainability.

Louis *et. al*. (2013) in their study used innovative methodology by using self-organising map methodology. This methodology is used to study existing heterogeneity among institutions. This study investigates the trade-off between social efficiency & financial performance by using data sets of 650 microfinance institutions withdraw from the mix market i.e. (A Global database of MFIs). The study uses three indicators of outreach such as depth of outreach to women & average loan size/GNI per capita. The real yield on gross portfolio & profit margin is used as profitability

indicators & gross loan portfolio to asset & cost per loan is used as efficiency variable. The portion of women borrower is used as continuous variable. The findings of the study reveal that there is no trade-off between social performance & financial performance .The evidence of empirical research depicts the positive relationship between social & financial performance.

Kapisha and Zhang (2013) examine the tradeoffs between sustainability, profitability and outreach to poor by using unbalanced panel data sets of 47 MFIs for the period 2008 to 2011 in east Africa. Average loan balance per borrower adjusted by GNI per capita, the number of active borrowers and percentage of women borrowers are used as proxies for measuring outreach. Operational self-sufficiency ratio is a proxy for sustainability. Return on assets as a proxy for Profitability. Their findings confirm tradeoffs between outreach to poor with profitability and absences of tradeoffs with sustainability measures. They suggest that MFIs can focus on sustainability to enable those covering operating costs with less dependence on subsidies without compromising outreach to poor.

Hermes *et. al.* (2011) in their empirical evidence, "outreach & efficiency of microfinance institution" found convincing evidence that outreach is negatively related to the efficiency of microfinance institutions. The large data sets of 435 institutions for the period of 1997-2007 were used to determine the relationship between cost efficiency of MFIs & the depth of outreach measured on the basis of average loan balance & percentage of women borrowers. They applied SFA (stochastic frontier analysis) model to calculate the cost efficiency of microfinance institution & then correlation analysis to determine the trade-off between outreach & efficiency .Their finding suggests that MFIs that have more women borrowers & lower average balance are also less efficient .The findings of the correlation between measures of efficiency & outreach show that outreach is negatively related to the efficiency of MFIs.

Quayes (2012) in his paper investigate the dynamic relationship between the depth of outreach & financial sustainability. The data of seven hundred three MFIs from eighty-three countries for the year 2006 were taken from mix (microfinance information exchange). The average loan size /GNI, the percentage of women borrowers is used as outreach indicator. Gross loan portfolio, total equity, debt to equity, total expense ratio, cost per borrower, and dummy variable of operational self-

sufficiency is used as financial efficiency variable. Ordinary least square & regression analysis is applied to investigate the relationship between financial efficiency & outreach. They did not find any evidence of trade off except for low disclosure MFIs.

Wydick *et. al*. (2011) investigated about the nature of the influence that social network has on credit access & factors affecting outreach .This paper uses new approach in determining the role of social networks in determining credit access. He conducted survey of 465 households in western Guatemala for gathering information on education, ownership of different assets, membership in churches & participation in village committee. Information was gathered by asking question from the related to purchasers of new consumer goods such as bicycles, television cell phones & information source for accessing credit. With the help of regression equation effects of social networks at the neighbourhood, church & village levels for borrowing credit is estimated. The empirical finding of the study suggested the presence of endogenous peer effect for borrowing credit are similar to those found in the purchase & ownership of consumer goods of bicycles, cell phones & television. They find that the effect of social groups is significant in credit access. They also find that microfinance borrowing is positively related with the level of education but negatively related to wealth level of social network household's village & church.

Serrano-Cinca & Gutiérrez-Nieto (2014) identified the microfinance mission following the Pareto's 80/20 principle. The empirical findings of the study are based on data set of 1000 microfinance institution from the MIX market for the year 2006 to 2010. The datasets of 1000 microfinance institutions have been categorised into two groups i.e. (the most centered MFIs & the most drifted MFIs). The most drifted MFIs indicate failure of the social mission of microfinance. The findings of the study reveal that some MFIs have drifted from their social mission. This study is highly relevant for donors, social investors & rating agencies. The findings of the study suggest that there is a need to reduce the interest rate. This can be done by using efficient technology as in other sectors.

Quayes (2012) presented first empirical evidence of positive relationship between the depth of outreach & financial self-sufficiency by using large data sets of 702 MFIs operating in 73 countries. Based on the quality of information provided by MFIs to mix market. MFIs have categorized into two group i.e. low disclosure MFIs & high discloser MFIs. The finding of the study revealed that financial sustainability has no

impact on outreach. The result on the basis of disclosure level revealed tradeoff for the low disclosure MFIs. However, high disclosures MFIs have positive relationship between outreach & financial sustainability. The depth of outreach increases financial sustainability for high disclosure MFIs. Low disclosure MFIs depth of outreach has no impact on financial sustainability.

Hermes and lensik (2007) provided large-scale systematic analysis of contributions revealed to the tradeoff between outreach and sustainability of microfinance institution. Their findings revealed that individual based MFIs focus more on the wealthier client in comparison to group based lenders.

Copestake (2007) analyzed mission drift by an innovative model that differentiates between financial and social performance possibilities, preferences and assessment system. The model is used to illustrate the relationship between social and financial performance and to give suggestion for policy analysis. The conceptual framework developed in this paper that distinguish between financial and social performance possibilities can be applied to determine how other financial institutions contribute to economic growth and equity goal.

The author (**Cull *et. al.*,** 2011) presented first empirical contribution revealed to the effect of regulation on MFIs profitability and outreach. This issue is answered by using the high quality balance sheet and income statements for 245 leading MFIs with supervision data of each MFIs. The findings of regression analysis revealed that profit oriented MFIs respond to supervision by maintaining profit rates but reducing outreach to women and core poor that are costly to reach.

Zeller and Meyer (2002) in their book brings together empirical research work done by IFRI researches and other collaborating institutions. For the microfinance practitioners, it provides judicious decisions of tradeoffs & what role finance can play in achieving long-term poverty alleviation and economic growth.

The author (**Hermes and Lensink,** 2011) provided detailed analysis of eight empirical contributions related to the two main question (i) does microfinance have an impact on the social and economic situation of the poor in developing countries (ii) are microfinance institution sustainable in the long terms and there is tradeoff between sustainability and outreach to poor. In-depth study of the reviewed symposium revealed that there is strong tradeoff between the outreach and sustainability (Hermes *et. al.* 2011) similarly transforming MFIs into banks does not have any positive

consequences for the poor (Cull *et. al*. 2011). The symposium of Hudon and Traca (2011) conclude that subsidies do not compromise with the efficiency of MFIs as long as subsidy level remains moderate. This paper supports the view that financial sustainability is not only necessary when aiming the long term viability of microfinance. The findings of (Wydick *et. al.,* 2011) symposium revealed that use of existing social network between existing and potentially new client increased outreach to poor and reduce costs of reaching outreach to poor and reduced cost of reaching out. The size of trade off i.e. improving the financial sustainability of an MFI mean in terms reducing outreach to the poor client is first studied by Galema and Lensink (2009). Their result suggests that trade-off is particularly severe for group that is typically targeted by MFIs.

Mersland & Storm (2008) examined the impact of the type of ownership on Microfinance organization performance. This study considers six aspects of performance dimensions namely cost, depth, breath, length, scope and worth. Multivariate logit regression is used to predict the organizational type of either NGO or shareholder fund. The empirical evidence is based on database of 200 nongovernmental or shareholder MFOs representing 54 countries. The findings of the study revealed that difference is minimum between SHFs and NGOs in terms of social and financial performance.

2.4 LOAN REPAYMENT PERFORMANCE

Bassem (2013) examined the relationship between MFIs governance and repayment performance. The empirical investigation is based on data of 250 MFIs from Mix market database from different countries. The portfolio at risk 30 days is used as a dependent variable and proxy for loan repayment performance and other firm-specific variables as independent variables. The results indicate that MFI's size and use of individual level model improve the loan repayment performance. However, the MFIs age positively affects the percentage of portfolio at risk

Aseefa, Hermes and Meesters (2010) examined the effect of competition among MFIs on their performance. They used innovative approach by constructing Lerner index, they assessed the effect of increase competition on outreach, loan repayment performance and financial performance. The empirical investigation is based on datasets of 362 MFIs taken from MIX market database over the period 1995-2009.

The study concluded that competition is negatively associated with outreach while it is positively associated with rising defaults. Increased competition is negatively associated with efficiency of MFIs.

Mosbah, Slama and Mostorakis in their paper identified determinants of loan repayment default phenomenon. Data of 30 MFIs is withdrawn from MIX (Microfinance information exchange) market database in MENA region. Their regression findings revealed that average loan balance per borrower and gross loan portfolio positively affects the portfolio at risk. Moreover, empirical findings confirm that higher percentage of female clients is associated with lower portfolio at risk.

Crabb & Keller (2006) in their empirical work used data of 37 MFIs studied over 12 quarters of individual trust bank and group lending model located in different countries. To determine how lending methodology contributes to loan repayment performance measured by using portfolio at risk 30 days. Their findings revealed that group lending methodologies reduce the risk in MFIs portfolios compared to individual loans. However, greater lending to women raises portfolio at risk.

CONCLUSION

To conclude, it is found that the present chapter is a window to the whole study. It depicts an overview about the whole idea behind the proposed research work by discussing the review of literature which helped the researcher in finding the research gap. The literature has been reviewed related to research issues covered in this study such as financial self-sufficiency, operational self-sufficiency, portfolio at risk and trade-off between financial self-sufficiency and outreach to female clients and poor. The next chapter discusses the research methodology used to analyze the data.

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3.0 INTRODUCTION

The research methodology is an important part of research describes the entire methodological process used to collect and analyse data in the study. This chapter discusses about the research methodology and design of the study. This chapter also discusses about the proxy measures of various MFIs specific variables used in this study. The present study is quantitative research and tries to analyse the factor affecting operational and financial sustainability and factors influencing loan repayments performance and outreach to poor and women and furthermore Trade-off between sustainability and outreach. The study focuses on only Andhra MFIs which report data to MIX market. Only 10 MFIs have been selected for this study. Furthermore, this study employed pooled OLS, fixed effect and random effects models of panel data.

3.1 POPULATION AND SAMPLE DESIGN

The empirical findings of the study are based on the financial data of Microfinance institutions withdrawn from MIX market (Microfinance Information Exchange database). Mix market provides information about historical and social performance information data of more than 2100 microfinance institutions worldwide serving about 94 million clients. The study is based on the unbalanced panel data consists of 10 Microfinance institutions representing over the period 2005 to 2013 with total 76 observations. As of 31st March 2013 around 200 Indian Microfinance institutions reported data to the MIX. Out of 18 Andhra's Microfinance institutions 10 have been selected for this study. The criteria for selecting the MFIs were based on the time period of 9 years (2005-2013). However data provide by these institutions was incomplete. Hence, those institutions which report at least 5 years data from the period 2005 to 2013 to MIX database have been selected. Finally, On the basis of this criterion 10 MFIs have been selected. Therefore on the basis of sample size and time period our data is unbalanced panel data with 76 observations.

After fulfilling the above criteria, the unbalanced panel data of 10 microfinance institutions for 9 years period 2005 to 2013 is used for analysis and interpretation. These microfinance institutions are representative of around 55% of total number of microfinance institutions in Andhra Pradesh given their size and age.

It has been attempted to include all categories of size (large, medium and small) and age (old, medium and young) MFIs.

3.1.1 Sampling Technique

The purposive sampling technique on the basis of following points given below is adopted. Only those MFIs which follow the followings assumptions are selected for the present study.

1. Only those MFIs which report data to the MIX market (Microfinance information exchange) of Andhra Pradesh are taken into consideration for this study.
2. Out of the 18, Andhra MFIs which report data to the MIX, 10 MFIs have been selected. Only those MFIs which are operating during the period 2005-2013 are selected.
3. Only those MFIs which report at least five years data during the period 2005-2013 is selected for the present study.
4. MFIs do not provide full information regarding the variables. Some observations are missing in the data.

After fulfilling the above criteria, the unbalanced panel data of ten firms for nine years during the period (2005 to 2013) are taken into consideration.

3.2 SOURCES AND MEANS OF DATA

The study focuses greater emphasis on data accessing the significant determinants of financial self-sufficiency, operational self-sufficiency, portfolio at risk and outreach to poor and women of Andhra Microfinance institutions. The study is based on the secondary data taken from Mix market database (Microfinance information Exchange). It is a database of worldwide microfinance institutions where MFIs reports financial and social performance data. The data comprised of financial ratios and some outreach indicators. On the basis of data availability and sample size only 10 microfinance institutions have been selected for this study. Furthermore, research reports of the various contributors on the subject matter, articles in various journals, magazines, newspapers and other published literature on the subject have been screened to gather required information for the study. Finally, raw data collected have been converted into the ratios and classified according to the requirement of the study.

3.3 RESEARCH DESIGN

This study attempts to determine the factors affecting financial sustainability, operational sustainability, portfolio at risk and outreach to poor and women and tradeoff between outreach and financial performance of Andhra Microfinance institutions. The quantitative data analysis approaches to establish cause and effect relationships based on factors or determinants on previous studies as explained below in section **3.7** and empirical analysis in chapter **5**. The study is based on the data withdrawn from Microfinance information exchange (MIX) database of only Andhra MFIs. Out of the 18 Andhra MFIs which report data to the MIX market, 10 was selected based on the criteria as mentioned under the head sampling technique. The study is based on the data of 9 years (2005 to 2013) withdrawn from MIX market. The study is empirical in nature with the objective to determine factors affecting financial sustainability, operational sustainability, portfolio at risk and tradeoff between financial sustainability and outreach. The study follows quantitative approach on the unbalanced panel data.

The use of panel data enhances tracking variables changes in measured variables and relationship overtime (Hair *et al,* 2006). It allows us to control for unobserved characteristics of individuals cases or MFIs and facilitates causal inferences in situations where inferring causality would be very difficult in case if we had only single year cross sectional data. According to (Gujarati, 2003) by studying repeated cross-sectional data of same cases or firms, Panel data is considered better to study dynamic changes. Furthermore, panel or longitudinal data help us to study the importance of lags in the behaviour. This study used the pooled OLS model, fixed effect model and random effect model of panel data. However, the study tries to check the consistency of results by using all the three models independently. Finally Gretl. version 1.9.12 software is used to generate regression results and panel diagnostics command in Gretl. to determine most appropriate model. On the basis of the result of F test, Hausman test and Breusch pagan test most appropriate model is determined and finally our result and interpretation are based on the most appropriate model.

3.4 DATA ANALYSIS

The secondary data withdrawn from MIX market were entered in a spread sheet before analysing them using GRETL. Econometric software. The data was rearranged in a manner that facilitated the easy tracking of key variable required for the present

study. The analysis was set to indicate, which of the determinants of the reported in the literature are relevant to Andhra microfinance institutions and secondly what are factors that significantly affects the financial sustainability, operational sustainability, portfolio at risk and outreach to poor and women clients. The measurement and description of the variables affecting financial sustainability, operational sustainability portfolio at risk and outreach to poor and women are discussed in the same chapter. Specific data analysis and interpretation are discussed in chapter **5** and **6**.

3.5 DEALING WITH THE OMITTED VARIABLES

Coefficients derived from single ordinary multiple regression models may subject to omitted variable bias. If some variables which were not included in the model may affect the independent variable and therefore estimating coefficients without controlling for these variables may lead to omitted variable bias, one need to control for the unobserved effect of omitted variables. However, the control is completely dependent on the nature of control variables. Firstly whether these are constant variables or change over time. Secondly, these are constant variables or changing over cases. These two methods are also known as time specific or individual specific effects of omitted variables (Hsiao, 2007). Econometrics researchers suggest two very common methods for dealing with omitted or unobservable variables i.e. fixed effect methods and random effects method (Gujarati, 2003; Baltagi, 2008; Greene, 2003; Woodridge, 2006).

3.6 THE CONCEPTUAL MODEL

The study makes use of pooled ols, fixed and random effect model of panel data to explain the relationship between dependent and independent variables. Longitudinal data or panel data are datasets of same items or individuals collected over period of time. (Johnson and Dinardo, 2007; Wooldridge, 2006; Baum, 2006). In the words of (Gujarati, 2003) panel data is the combination of cross-sectional and time series data. In simple words, data of individuals, firms or companies collected over different time period i.e. yearly, monthly, and half-yearly and annually. As the panel data relates to the individuals or firms over time and therefore is bound to be heterogeneous in these individuals. The techniques in panel data can consider such heterogeneity explicitly into account by allowing for individual or firm specific (MFI specific) variables (Gujarati, 2003). In this study, it was expected to establish the relationships between

dependent and independent variables with specific focus on factors affecting financial sustainability, operational sustainability, portfolio at risk and tradeoff between financial sustainability and outreach. Therefore panel data is considered an ideal for this study.

The panel data is considered better to detect and measure relationship that cannot be detected in pure time series or pure cross-sectional data (Gujarati, 2003; Wooldridge, 2006). Furthermore panel data provide more informative data, more variability, high efficiency, less degree of freedom and less collinearity among variables. The conceptual or general regression panel model data used in the form:

$$Y_{it} = \alpha_i + \beta' X_{it} + \varepsilon_{it}$$

Y_{it} = Dependent Variable for cross-sectional units i at time t, where i = 1…..n and t = 1, …., T; α_i is a heterogeneity or individual effect. It possesses a constant term and set of individuals or group specific variables which may be measured, such as the type of MFIs, lending methodology and so on and also unobserved MFIs specific characteristics (likes skills of personnel or preference and so on) which are supposed to be constant over time (Greene, 2003). β the partial effect of X_{it} in the period t for the unit i; X_{it} represents the J^{th} explanatory variables for the unit i at time t. There are K explanatory variables indexed as j = 1…..K and therefore, X_{it} is a K-dimensional vector; and ε_i is the error term (Greene, 2003; Gujarati, 2003). The specific panel data models employed in this study i.e. pooled, fixed and random are discussed below.

3.6.1 Pooled regression Model: Pooled regression model is used when groups to be pooled out are relatively similar or homogenous. This model can be directly run using ordinary least squares on the consented groups. If the models yield large standard errors (small T statistics) it indicates a warning flag that the group are not all that homogenous (similar) and random effect model may be more appropriate. It does not consider the individual or time effect that could lead to the risk of observing overestimate bias in the significance of coefficient (Barclay *et. al*., 1995; Bevan and Danbolt, 2004). However, in the case of heteroscedasticity in data, the variance of OLS estimator is not provided by the usual OLS formulas. Therefore using the ordinary, the T and F test statistics can be highly misleading and may result in enormous conclusion (Gujarati and Sangeetha, 2007). The specific models of pooled OLS regression for factors affecting financial self-sufficiency, operational self-sufficiency, portfolio at risk, outreach to poor and women and the tradeoff between

Sustainability and outreach and have been discussed in chapter **5** i.e. Results and discussion.

3.6.2 Fixed effect model: Fixed effect model measures group differences in intercept for each by using a separate dummy variable for each group because of this reason it is also known as least squares dummy variable method. The differences in intercept for each dummy variable are calculated assuming constant slope (coefficients) for independent variables and constant variance across groups. It includes on an intercept for each individual to measure individual specific effects and coefficients estimates reflect within individual variation. It does not consider unit specific residual and considers them nonrandom. If the dummies are considered as a part of intercept for each individual to measure individual specific effects and coefficients estimates reflects within individual variation. It does not consider unit specific residuals and considers them nonrandom. If dummies are considered as a part of intercept than it is known as fixed model. While in random effects model dummies act as an error term. Least square dummy variable and within effect estimation methods are used with fixed effect models. However, ordinary least square (OLS) with dummies in fixed effect model. It is tested by the incremental F test (Gujarati and Sangeetha, 2007). A fixed effect model examines the group differences in intercept assuming constant variance across subjects and same slope. The specific models of fixed effect regression for factors affecting financial self-sufficiency, operational self-sufficiency, portfolio at risk, outreach to poor and women and the tradeoff between outreach and financial sufficiency have been discussed in chapter **5** i.e. Results and discussion.

3.6.3 Random effect model: In random effect model variables are assumed to be uncorrelated with all the observed variables. This model leverages the differences in the variance of the error term to models group together, assuming intercept and slopes. This model is used in the analysis of hierarchical or panel data when one assumes that there is no fixed effect. This model is assumed to be random and coefficients variations are based on average variation between individuals and within individuals. Individual error component term should be correlated to any regressors. Otherwise, the assumption of ordinary least square is violated. This method used generalised least square (GLS) when the variance structure is known. If the variance structure is not known, feasible generalized least square method is used (Greene,

2003). Breusch Pagan or LM test is used to examine random effects model. However, it is a challenging job for the researcher to decide whether to used fixed effect model or random effect model. Fixed effect model is appropriate when (ε_i) and X regressors are correlated and the random effect is appropriate when (ε_i) and the X regressors are uncorrelated. Random effect model is considered better in terms of degree of freedom and estimation. Random effects economies in terms of degree of freedom and does not require cross section units (N) rather require estimation of mean values of intercept and its variance. The specific models of random effect regression for factors affecting financial self-sufficiency, operational self-sufficiency, portfolio at risk, outreach to poor and women and the tradeoff between outreach and financial sufficiency have been discussed in chapter 4 i.e. Results and discussion.

3.6.4 Model Specification: Pooled OLS vs Fixed effect vs Random effect

In order to arrive unbiased result, the present study used pooled, fixed and random effects model. To determine the most appropriate model, the choice between pooled OLS and Fixed effect model is decided by F test; the choice between pooled OLS and random effect model is determined by Breusch pagan test and finally a choice between fixed effect and random effect model is determined by Hausman test. However, in order to check consistency, the study employed the entire three model. But, Interpretation and result are based on the most appropriate model. How to determine most appropriate model on the basis of these test is shown in the following table **3.1** given below.

Table 3.1 Selection criteria of most appropriate model

Fixed effect (F test or Wald test)	Random effect (Breusch-Pagan LM test)	Your model
H0 is not rejected (No fixed effect)	H0 is not rejected (No random effect)	Data are poolable. Pooled OLS
H0 is rejected (fixed effect)	H0 is not rejected (No random effect)	Fixed effect model
H0 is not rejected (No fixed effect)	H0 is rejected (random effect)	Random effect model
H0 is rejected (fixed effect)	H0 is rejected (random effect)	(1) Fixed and random effect model1 or (2) choose one of the two depending on the result of Hausman test (recommended direction).

Source: Park (2015)

3.7 RESEARCH HYPOTHESIS

The main motive of this study is to investigate the direct impact of firm specific or MFI specific variables on financial self-sufficiency, operational self-sufficiency, portfolio at risk and outreach to poor and women and relationship between outreach and sustainability. The hypothesis has been suggested on the basis of prior theoretical and empirical evidence of related work. Nevertheless, the following hypothesis has been suggested for empirical analyses in the present study and acceptance and rejection of hypothesis is based on the significance of the result. Section **3.7.1** discusses definitions of independent variable and hypothesis related to factors affecting financial self-sufficiency model. Section **3.7.2** discusses definitions of independent variables and hypothesis related to factors affecting operational self-sufficiency model. Section **3.7.3** shade light on definitions of independent variable and hypothesis related to factors affecting portfolio at risk model. Section **3.7.4** is about definitions of the independent variable and hypothesis development related to outreach model of the percentage of female borrowers. Section **3.7.5** states about definitions of independent variables and hypothesis related to outreach model of average loan balance measured by average loan balance per borrower.

3.7.1 Definitions of independent variables and their expected Hypothesis for FSS model

This section states about definitions of independent variables and their expected hypothesis sign related to factors affecting financial sufficiency model. Hypotheses of the study, In line with the main objective of the study, the researcher have developed the following hypotheses based on the theories and empirical studies discussed in literature related to financial self-sufficiency.

3.7.1.1 Real gross portfolio yield

Portfolio Yield is a percentage that shows the Microfinance Institutions ability to generate revenue to covers its Financial & operational expenses. It represents the average gross returns as a proportion of portfolio outstanding. It shows the amount received from interest payments during the period by Microfinance institutions. In case the MFIs following cash accounting system the portfolio yield will not include (interest & fee) income generated by the delinquent loan. It indicates the efficiency of microfinance institution in generating cash revenue from their outstanding loan portfolio. In simple words, Portfolio Yield shows how much on average the MFIs

receives in interest payment on its loan. It is a good indicator of delinquency as if Portfolio at risk is low (as reported by MFI) if the yield is lesser than expected than there is delinquency (Sa-Dhan, 2006).

The study of (Cull *et. al*., 2006) indicates the coefficient for gross loan portfolio yield is positive & significant with all three measures of financial performance (financial self-sufficiency, operational self-sufficiency and return on assets indicating that individual based lenders earn more profit than their average interest are higher. However, the result is quite different for village banks or solidarity lenders. For Group lenders & solidarity lenders, there is not significant relationship between interest rates & profitability even after controlling for the cost. Rahman & Mazlan (2014) empirical findings revealed the significant and positive relationship between the yield on gross loan portfolio and financial self-sufficiency. The study of (Crombrugge *et. al.,* 2008) shows the gross portfolio yields affects the financial self-sufficiency. The findings of the study show financial self-sufficiency is positive through interest & fees revenues. The study of Woller and Schreiner (2002) shows that real portfolio yield is a statistically significant determinant of financial self-sufficiency. Adongo & stork (2005) found that all the financial institutions during the selected period were financially unsustainable. The study suggests that they were not charging enough interest rates that can cover all financial costs and non-financial costs and risk of their operation. The study of Cull *et. al.* (2006) shows that interest rates are related to improved financial performance for individual lenders only. Nyamsogoro (2010) empirical findings revealed a positive relationship between the yield on gross loan portfolio and financial self-sufficiency. Hence, based on the earlier empirical evidences, the following hypothesis is framed.

H_1: There exists a positive relationship between the yield on gross loan portfolio and financial self-sufficiency.

3.7.1.2 Capital cost to total assets ratio

The capital cost to total assets ratio is used as a standard inverse proxy of leverage, especially in banking research because regulatory attentions are paid to capital assets ratio (Berger and Bonacossrsi di Patti, 2006). In the context of financial performance agency costs hypothesis states that increasing leverage or decreasing capital assets ratio is associated with reduction in agency cost of outside equity and improvement in financial performance. Kar (2010) concludes that reduction in capital cost ratio may

raise efficiency. (Gebremichael, 2013) predicted a positive relation between capital assets ratio and financial self-sufficiency. Accordingly, the following hypothesis is predicted.

H_2: There exists a negative relationship between capital cost to assets and financial self-sufficiency.

3.7.1.3 Gross loan portfolio to total assets ratio

Gross loan portfolio to total assets ratio is an indicator of financing structure. It is the ratio of adjusted gross loan portfolio to adjusted total assets. It is an indication of their focus of lending as otherwise these funds could have been utilized for some income generating purpose. Tehulu (2013) also predicted that loan intensity affects positively to financial sustainability and his findings show that the coefficient of the gross loan portfolio to total assets ratio is positive and significant at 5% level. Cull *et. al.* (2007) empirical findings revealed a positive relationship between gross loan portfolio to total assets ratio and financial sufficiency. Kar (2010) also expected the uncertain relationship between gross loan portfolio and financial self-sufficiency. However, based on the prior empirical evidence, positive relationship between financial performance and gross loan portfolio to total assets ratio is predicted. Accordingly, the following hypothesis is suggested:

H_3: There exists positive relationship between gross loan portfolio to total assets ratio and financial self-sufficiency.

3.7.1.4 Average loan balance per borrower

Average loan size is taken as a proxy for depth of outreach. It measures the efficiency of microfinance institutions in selling loans. It is calculated by dividing average gross loan portfolio by number of active borrowers. The size of loan can affect FSS and even portfolio at risk. However, larger loans may be riskier than smaller loans, but their cost per rupee is assumed to be small if there is some fixed cost per loan. The size of the loan is often taken as indicator for coverage i.e. ability of MFIs to reach poor, as poor people are expected to avail for smaller loan than larger amount of loan (Croumbrugghe *et. al.* 2010) It is interesting to determine how important the effect of the size of the loan and to determine how MFIs perform for given loan size. The findings of the study of Gonzalez (2007) shows that larger loans are associated with higher cost efficiency and thereby profitability. However, the findings of Cull *et. al.* (2007) is against the findings of above two studies. The study revealed that the Micro

banks or MFIs which provide smaller loans are not less profitable than those which provide bigger loan. The findings of the study revealed that the average loan sizes are not strongly associated with financial performance indicators. Institutions which provide larger loans are not less profitable than which provide bigger loan amount. Woller and Schreiner (2002) found that the depth of outreach is inversely related with financial self-sufficiency. Nyamsogoro (2010) study also indicates that average loan size is positively and significantly related with financial self-sufficiency. Adongo and Stork (2005) found that profitability is related to bigger or wealthier loan size per borrower. Therefore, based on the review of prior empirical and theoretical evidence the following hypothesis is suggested.

H_4: There exists a positive relationship between average loan balance per borrower and financial self-sufficiency.

3.7.1.5 Portfolio at risk (30 days)

Portfolio at risk indicates that how much an MFI is efficient in making collections of loans. Higher PAR indicates inefficiency of MFIs i.e. indicates lower repayment rates. Lower the PAR the more inefficient the microfinance institutions will be and thereby financially sustainable. Portfolio at risk captures the accounting convention that loans exceeding 30 days overdue poses an unacceptably high risk of non-repayment (Kar, 2010). He predicted an inverse relationship between PAR (30) and profit efficiency and his findings show the negative insignificant relationship between PAR (30) and firm performance. The study of Cull *et. al.* (2007) conclude that higher interest rates are associated with higher rates of non-repayment but for individual based lenders only. Moreover, according to one specification individual based lenders charging higher interest rates higher profit than those charging interest intermediate rates. Tehulu (2013) also found that credit risk measured by PAR (30) days found to have a negative and significant impact on the financial sustainability of MFIs. The empirical findings of Nyamsogoro (2010) disclosed that there is a statistically significant and negative relationship between portfolio at risk and financial sustainability. Thus, in the line with prior studies, the following hypothesis is proposed.

H_5: There exists a negative relationship between portfolio at risk and financial self-sufficiency.

3.7.1.6 Personnel productivity ratio

Personnel productivity measures the amount of quality services delivered by microfinance institutions staff to their customers. The findings of the Cull *et. al.* (2007) shows that there is negative relationship between charging higher interest rates and having a large customer base. Accordingly, the following hypothesis is suggested.

H_6: There exists an uncertain relationship between labour cost to assets and financial self-sufficiency.

3.7.1.7 Size

The size of an MFI is defined as the natural logarithm of total assets of the MFIs. Hermes *et. al.* 2011; Mersland and Strom (2009); Bogan *et. al.* (2007); Hartarska (2005) shows that the MFI size does not affect its financial sustainability. While the study of Mersland and Strom (2009) and Bogan *et. al.* (2007) Hartarska (2005) used total value of its assets as MFIs size indicator. The study of Hartarska (2005) shows that the MFIs size did not affect its financial sustainability. While the study of Mersland and Strom (2009) and Bogan *et. al.* (2007) revealed that the size of an MFI is associated with its financial sustainability. The empirical findings of Cull *et. al.* (2007) shows that size of MFI is statistically significant and positively linked to its financial performance. The study of Nyamsogoro (2010) found that the size of MFI significantly affects its financial sustainability. Similar findings were also disclosed by the study of Cull *et. al.* (2007); Robinson (2001); Bogan *et. al.* (2007); Mersland and Strom (2009). Therefore in the line with prior empirical findings, the following hypothesis is suggested.

H_7: There exists a positive relationship between the size of MFIs and financial self-sufficiency.

3.7.1.8 AGE of MFIs

The study of Cull *et. al*. (2007) revealed that the age of MFIs is significantly & positively related with all three measures of sustainability i.e. (FSS, OSS & ROA). The study of Gonzalez (2007) depicts that the age of Indian MFIs never comes up significant with financial self-sufficiency & operational self-sufficiency. The findings of Robinson (2001) imply that age is significant variable to effect financial self-sufficiency. The findings by Nadiya (2011) show that relationship between age of MFIs & operational self-sufficiency is not significant for determining changes in operational self-sufficiency. The study of Bogan *et. al.* (2007) shows that the age of

mfis is related to financial sustainability. Nyamsogoro (2010) found that age of microfinance institution is not significantly related with financial self-sufficiency. Hence, in the line with prior studies the following hypothesis is proposed.

H_8: There exists a positive relationship between age of MFIs and financial self-sufficiency.

Table 3.2: Definitions of independent variable and their expected hypothesis sign related to Financial self-sufficiency model and Operational self-sufficiency model.

S/N.	1. Variable Standard Name	Description	Variable description as used in regression model	Expected effect on the FSS/OSS.
1.	Real Gross Portfolio Yield	(Yield on gross portfolio (nominal) - Inflation rate) / (1+ Inflation rate)	YOGP	Positive
2.	Capital to Assets ratio	Adjusted total equity/Adjusted total assets	CCTA	Negative
3.	Gross loan portfolio to total assets ratio	Gross loan portfolio/total assets	GLPTA	Positive
4.	Average loan balance per borrower	Adj. GLP/Adj. Number of Active Borrowers	l_ALBPB	Positive
5.	Portfolio at risk	The fraction of loan portfolio that is overdue past 30 days or more; that is PAR 30 = Portfolio at risk/Gross loan portfolio	P30	Negative
6.	Labour cost to assets	Personnel expenses/total assets	PEA	Positive or negative
7.	SIZE OF MFI	The size of MFIs measured by value of its Assets	l_ASS	Positive
8	MFI AGE	Years since its establishment to when evaluation is considered. It also measure length of it outreach.	AGE	Positive

3.7.2 Definitions of independent variables and their expected Hypothesis for OSS model

This section states about definitions of independent variables and their expected hypothesis sign related to factors affecting Operational self-sufficiency model. Hypotheses of the study, In line with the main objective of the study, the researcher have developed the following hypotheses based on the theories and empirical studies discussed in literature related to Operational self-sufficiency**.**

3.7.2.1 Yield on gross loan portfolio

Cull *et. al.* (2006) & (2007) found that coefficient for real gross portfolio yield is positive and significant across all the three profitability indicators (financial self-sufficiency, operational self-sufficiency and return to assets). Woldeyes (2012) found that yield on gross loan portfolio is highly significant and positive with operational self-sufficiency. Rahman and Mazlan (2014) found that yield on gross loan portfolio measure of interest rates is insignificantly but positively associated with operational self-sufficiency. Therefore, in line with prior studies, the following hypothesis is suggested.

H_9: There exists a positive relationship between the yield on gross loan portfolio and Operational self-sufficiency.

3.7.2.2 Capital cost to total assets ratio

Cull *et. al.* (2006) & (2007) found that coefficient on the capital cost variables differences for the different loan lending methodology of MFIs to generate profits. In the context of financial performance agency costs hypothesis states that increasing leverage or decreasing capital assets ratio is associated with reduction in agency cost of outside equity and improvement in financial performance (Kar, 2010). Accordingly, the following hypothesis is suggested.

H_{10}: There exists a negative relationship between capital cost to assets and Operational self-sufficiency.

3.7.2.3 Gross loan portfolio to total assets ratio

Gross loan portfolio to total assets ratio is a measure of risk exposure. In order to control for Microfinance institutions on social mission this variable is included in our models. Cull *et. al.* (2007) empirical findings revealed positive but insignificant association between gross loan portfolio and financial self-sufficiency. However, the relationship is significant with another measure of financial self-sufficiency and

returns on assets. Kar (2010) also predicted the uncertain relationship between profitability and loan to assets ratio. Accordingly, the following hypothesis is suggested.

H_{11}: There exists a positive or negative relationship between gross loan portfolio to total assets ratio and Operational self-sufficiency.

3.7.2.4 Average loan size per borrower

The study of Nadiya (2011) shows that average loan size is significantly and positively related with operational self-sufficiency. Rahman and Mazlan (2014) findings observed the insignificant relationship between average loan size per borrower and operational self-sufficiency. Woldeyes (2012) empirical results show significant and positive relationship between average loan size per borrower and operational self-sufficiency. Therefore in the line with prior studies, the following hypothesis is proposed.

H_{12}: There exists a positive relationship between average loan balance per borrower and Operational self-sufficiency.

3.7.2.5 Portfolio at risk (30) days

Portfolio at risk is used as a measure of risk exposure. Portfolio at risk captures the accounting convention that loans which are overdue more than a month. Kar (2010) findings revealed that coefficients for the portfolio at risk negative and insignificantly related with financial performance measure. In general portfolio at risk and financial performance is negatively associated. Accordingly, the following hypothesis is suggested.

H_{13}: There exists a negative relationship between portfolio at risk and Operational self-sufficiency.

3.7.2.6 Personnel productivity ratio

Cull *et. al*. (2007) empirical findings show that labour cost is associated with improved profitability for only individual based lenders. The relationship between labour cost to assets and operational self-sufficiency is hypothesised to be uncertain.

H_{14}: There exists a positive or negative relationship between labour cost to assets and Operational self-sufficiency.

3.7.2.7 Size

Hartarska and Nadolnyak (2007) study's examined the effect of the size of MFI on its financial self-sufficiency and operational self-sufficiency. Their empirical findings

revealed that operational self-sufficiency is positively associated with the size of MFI. Woldeyes (2012) findings revealed that size of MFIs is highly significant and positively associated with operational self-sufficiency. Rahman and Mazlan (2014) findings revealed that size of MFIs positively explains the operational self-sufficiency of MFIs. Bogan *et. al.* (2007) empirical findings support the notion that size is significantly and positively associated with operational self-sufficiency.

H_{15}: There exists a positive relationship between the size of MFIs and Operational self-sufficiency.

3.7.2.8 Age of MFIs

Woldeyes (2012) findings show that age of MFIs is negatively and insignificantly associated with operational self-sufficiency. Rahman and Mazlan (2014) concluded based on his empirical findings that age of MFIs has negative effect on operational self-sufficiency. Bogan *et. al.* (2007) also found that age of MFIs is related to operational self-sufficiency.

H_{16}: There exists a positive relationship between age of MFIs and Operational self-sufficiency.

Table 3.3 Definitions of the independent variable and their expected hypothesis sign related to factors affecting portfolio at risk model.

S/N.	Variable Standard Name	Description	Variable description as used in regression model	Expected effect on the .
1.	Real Gross Portfolio Yield	(Yield on gross portfolio (nominal) - Inflation rate) / (1+ Inflation rate)	YOGP	Positive
2.	Average loan balance per borrower to GNI per capita	(Average loan balance per borrower divided by GNI per capita)	ALBPBG	Negative
3.	Gross loan portfolio to total assets ratio	Gross loan portfolio/total assets	GLPTA	Positive or Negative
4.	Labour cost to assets	Personnel expenses/total assets	PEA	Negative
5.	Percentage of female Borrowers	Percentage of borrowers who are women.	POFB	Negative
6.	MFI AGE	Years since its establishment to when the evaluation is considered. It also measures the length of its outreach.	AGE	Positive
7.	SIZE OF MFI	The size of MFIs measured by value of its Assets	l_ASS	Positive

3.7.3 Definitions of independent variables and their expected Hypothesis for Portfolio at risk model

This section states about definitions of independent variables and their expected hypothesis sign related to factors affecting Portfolio at risk model. Hypotheses of the study, In line with the main objective of the study, the researcher have developed the following hypotheses based on the theories and empirical studies discussed in literature related to Portfolio at risk**.**

3.7.3.1 Yield on gross loan portfolio

Stiglitz and Weiss (1981), Crombrugghe *et. al.* (2008) and literature surveyed in Ahlin and Townsend (2007) found positive relationship between portfolio at risk and yield on gross loan portfolio. Economic theory also predicts positive relationship interest rate and portfolio at risk. Cull *et. al.* (2007) empirical findings revealed the different relationship between yield and portfolio at risk for different types lending methodologies. Kar (2010) observed the negative significant effect of interest rates on loan repayment and suggested that quality of loan portfolio deteriorates at relatively low-interest rates.

HP_{17}: There is a significant positive relationship between the yield on gross loan portfolio and MFIs loan portfolios quality.

3.7.3.2 Average loan balance per borrower

Crabb and Keller (2006) empirical findings show that average loan size is insignificantly and negatively associated with portfolio at risk. Crombrugghe *et. al*. (2008) observed no significant correlation between average loan size and portfolio at risk. Mosbah *et. al.* (2008) findings revealed average loan balance per borrower is insignificantly associated with portfolio at risk.

HP_{18}: There is a significant negative relationship between Average loan balance per borrowers and MFIs loan portfolios quality.

3.7.3.3 Gross loan portfolio to total assets ratio

Cull *et. al.* (2007) empirical findings revealed loan to assets ratio is negatively associated with portfolio at risk and concluded that there is negative relationship between charging higher interest rates and having a large customer base. Kar (2010) found negative insignificant relationship between loan to assets ratio and portfolio at risk.

HP_{19}: There is a significant positive or negative relationship between gross loan portfolio to total assets ratio and loan portfolios quality.

3.7.3.4 Labour cost to assets

Cull *et. al.* (2007) found significant and positive relationship between labour cost to assets and portfolio at risk. Kar (2010) findings revealed the insignificant relationship between labour cost to assets ratio and portfolio at risk.

HP_{20}: There is a significant negative relationship between Labour cost to assets ratio of MFIs and MFIs loan portfolios quality.

3.7.3.5 Percentage of women borrowers

The percentage of loan extended to women is reliable indicator for measuring the depth of outreach of an MFI. Generally, by extending loan to women clients MFIs focus on the objective of women empowerment and poverty-fighting as women in developing countries perceived poorer than their male partner (Kar, 2010). Moreover, women borrowers perceived to be more reliable and have better reputation in terms of loan repayment performance. Therefore, the study supposes that women borrowers should negative affects portfolio at risk.

HP_{21}: There is a significant negative relationship between the ratio of women borrowers and MFIs loan portfolios quality.

3.7.3.6 Age

Coleman and Osie (2008) found a negative relationship between age of MFIs and its performance. Bassem (2009) found that that the age of MFIs is negatively correlated with the default probability. Soltane (2009) found that MFI age is negatively correlated with loan defaults. Therefore, the study supposes that MFI age will positively affect the loan repayment performance.

HP_{22}: There is a significant positive relationship between age of MFIs and MFIs loan portfolios quality.

3.7.3.7 Size

Fama and French (1993) concluded that firm performance is negatively associated with the size of MFIs. However, Coleman and Osei (2008) and Bassem (2009) concluded that large MFIs have the ability to accommodate to enhance productivity through diversification of product or services. Therefore, the study supposes that size will be positively correlated with repayment performance.

HP_{23}: There is a significant positive relationship between the size of MFIs and the MFIs loan portfolios quality.

Table 3.4 Definitions of the independent variable and their expected hypothesis sign related to outreach model of Percentage of female borrowers and Average loan balance per borrower adjusted by GNI.

S/N.	Variable Standard Name	Description	Variable Description as used in regression model	Expected effect on outreach variables, (POFB)and (ALBPBG)
1	Financial self-sufficiency	Adjusted Financial revenue/Operating expense+financial expenses+loan loss provisional expenses+Expense adjustment	FSS	Positive or negative
2	Operational self-sufficiency	Operating Revenue/Operating expenses+Financial expenses+Loan loss provisional expenses	OSS	Positive or negative
3	Age of MFIs	Years since its establishment to when the evaluation is considered. It also measures the length of its outreach.	l_AGE	Negative with depth and positive with and positive with breadth
4	Size of MFIs	The size of MFIs measured by value of its Assets	l_ass	uncertain
5	Portfolio at risk (30) Days	The fraction of loan portfolio that is overdue past 30 days or more; that is PAR 30 = Portfolio at risk/Gross loan portfolio	p30	uncertain
6	Capital cost to total Assets Ratio	(Rent+ transportation +depreciation +office + other) / total assets)	Ccta	uncertain
7	Gross loan Portfolio to Total Assets ratio	Gross loan portfolio/total assets	Glpta	Positive or Negative

3.7.4 Hypothesis for Percentage of women clients' model

The percentage of loan extended to women borrowers is a most widely used indicator for measuring the depth of outreach of an MFI. Generally, by extending loans to women clients MFIs generally focus on the social objective of women empowerment and poverty-fighting as women in developing countries generally perceived poorer than their male partner. Furthermore, women clients have better reputation reliability of in terms of loan repayment performance (kar, 2010). Therefore, women borrower should affect MFIs financial performance and loan repayment performance. Kapesha and Zhang (2013) empirical findings revealed significant negative correlation between depth of outreach measured by share of loan extended to women clients with both financial sustainability and profitability measures. Cull *et. al.,* 2007 found that sustainable individual based lenders MFIs lend more to women. They concluded that institutional design and orientation matters in considering tradeoffs in microfinance. Most of the study found positive impacts of Microfinance on women empowerment. Hermes *et. al*., 2011 observed that more focus on women clients increases the chances of low repayment rates which affects the sustainability and profitability of firms. On the basis of theories and empirical literature related to outreach to the percentage of female clients the following hypothesis is suggested.

HP_{24}: Financial self-sufficiency ratio is hypothesized to be positively or negatively associated with depth of outreach measured by the percentage of female clients.

HP_{25}: Operational self-sufficiency ratio is hypothesized to be positively or negatively associated with depth of outreach measured by the percentage of female clients.

HP_{26}: Age of MFIs is hypothesized to be negatively associated with depth of outreach measured by the percentage of female clients.

HP_{27}: Size of MFIs is hypothesized to be positively or negatively associated with depth of outreach measured by the percentage of female clients.

HP_{28}: Portfolio at risk is hypothesized to be positively or negatively associated with depth of outreach measured by the percentage of female clients.

HP_{29}: Capital cost to total Assets ratio is hypothesized to be positively or negatively associated with depth of outreach measured by the percentage of female clients.

HP_{30}: Gross loan portfolio to total assets ratio is hypothesized to be positively or negatively associated with depth of outreach measured by the percentage of female clients.

3.7.5 Hypothesis for Average loan balance per borrower: Depth of outreach model

Hulme and Mosley (1996) state that without focusing on core poor the supposed Microfinance institutions is also like a bank. They argue that depth of outreach should not be measured by just total numbers of client served but it should be based on no of poor clients served by MFI. Thus, the study used average loan size has been used as a proxy measure of the depth of outreach using relative level of poverty. Cull *et. al.,* (2007) concluded that financial self-sufficiency is not significantly related to outreach measures which indicate no mission drift. However, results vary by lending methodology, for individual based lenders findings revealed reverse mission drift. The study findings indicate that MFIs that make small loans are not less profitable than those MFIs making bigger loans. Hulme and Mosley (1996) found that delivering small loans to poor and relatively hard to reached core poor is very costly. Woller and Schreiner (2002) found that depth of outreach has positive relationship with financial self-sufficiency. Their findings show evidence against wide spread belief small loans are highly risky and related with lower financial sustainability. On the basis of theories and empirical literature related to outreach to the percentage of female clients the following hypothesis is suggested.

HP_{31}: Financial self-sufficiency ratio is hypothesized to be positively or negatively associated with depth of outreach measured by average loan balance adjusted by GNI.

HP_{32}: Operational self-sufficiency ratio is hypothesized to be positively or negatively associated with depth of outreach measured by average loan balance adjusted by GNI.

HP_{33}: Age of MFIs is hypothesized to be negatively associated with depth of outreach measured by average loan balance adjusted by GNI.

HP_{34}: Size of MFIs is hypothesized to be positively or negatively associated with depth of outreach measured by average loan balance adjusted by GNI.

HP_{35}: Portfolio at risk is hypothesized to be positively or negatively associated with depth of outreach measured by average loan balance adjusted by GNI.

HP_{36}: Capital cost to total Assets ratio is hypothesized to be positively or negatively associated with depth of outreach measured by average loan balance adjusted by GNI.

HP_{37}: Gross loan portfolio to total assets ratio is hypothesized to be positively or negatively associated with depth of outreach measured by average loan balance adjusted by GNI.

3.8 ASSUMPTIONS OF REGRESSION ANALYSIS

This section highlights the important assumptions of regression analysis that must be fulfilled before running the model of regression analysis. This section discusses the methods and techniques used to dealt with the assumptions i.e. normality, linearity, multicollinearity, autocorrelation and heteroscedasticity of regression analysis in detail.

3.8.1 Normality Assumptions

The first assumption that must be fulfilled is that sampling distribution of the mean is normal. The assumption of normality is very important when constructing reference interval for variables (Gujarati, 2003). It is very important that assumption of normality must hold, otherwise, coefficients of standard errors are biased and thereby leading to inaccurate and unreliable conclusions (Ghasemi and Zahedias, 2012). There are various techniques and test to determine normality of data such as Q-Q plots, P-P plots, Box plots, histogram, Shapiro-wilk test and Kolmogorov-smirnov test, skewness and kurtosis statistics e.t.c. This study uses Shapiro- Wilk test and Kolmogorov-Smirnov test. Furthermore, Q-Q plots are used to cross checked the results. The graphical tools are considered better than normality test like Shapiro-wilk test and kolmogorov-smirnov test because it represents the pictorial representation of variable by which we can identify the exact shape of distribution i.e. points depart from the straight line, than the study employed transformation techniques to transform the variable towards normality.

3.8.2 Transformation of data

As the researchers and econometricians prescribed various techniques of data transformation towards normality such as logarithm, square roots, reciprocals, power transform, and angular transformation. The log transformation technique is the most common technique in data analysis to transform the data towards normality. This

study uses the simple log transformation technique. It is used for transformation of non-normal data to normality and as a variance stabilizing transformation. Log transformation technique is considered as a best technique for exponential data.

3.8.3 Linearity Assumption

Researchers argue that this is the most important assumption, as it relates to the bias results of whole regression model (Keith, 2006). Linearity defines the dependent variable as a linear function of independent variable. The result of multiple regression analysis is considered unbiased and inaccurate when the relationship between dependent and inmpling

dependent variable is nonlinear in nature. The result of multiple regression analysis is considered appropriate when the relationship between dependent and independent variable is linear in nature. (Osborne and waters, 2002). If the assumption of linearity is violated than all the estimates of regression analysis including coefficients, standard errors and test of statistics are may be biased (Keith, 2006). If the relationship is not linear, regression analysis will over estimate or under estimate the true relationship i.e. increased risk of type or type two errors (Osborne and Waters, 2002). The present study has employed scatter plots to access the degree of linearity to detect any nonlinear pattern in data.

3.8.4 Multicollinearity

Multicollinearity also called collinearity refers to the assumption that independent variables at high levels related with one another or when one independent variable is near linear combination of other independent variable (Keith, 2006). If the more variables are related the less able researcher can separate the effects of variables. If the assumption of multicollinearity is not satisfied regression estimates produce misleading results, inflated standard errors, reduced power of regression coefficients, standard errors and t statistics may be misleading because of multicollinearity (Mason and Perrault jr, 1991).

3.8.4.1 Prevention of Multicollinearity

There are the various ways and methods to deal with the problem of multicollinearity such as keeping the model as it is despite collinearity problem, to combine overlapping variables and avoid including measures of the same conduct in a model, increase the sample size, standardization of variables, to use stepwise regression method, use of principal component analysis regression method. In this study, VIF

factor deeper investigate about multicollinearity problem. The variance inflation problem is an index of the amount the variance of each regression coefficient is increased over that with uncorrelated independent predictor variables (Keith, 2006).when a dependent variable has a strong linear relationship with other independent variables, if the association is large, it indicates the presence of multicollinearity. According to (Keith, 2006), the rule of thumb for the permissible limit is ten. It indicates no strong linear relationship. However, if VIF value is more than ten, it indicates the strong linear relationship between one predictor variable with another predictor variable.

3.8.5 Autocorrelation

Autocorrelation is also known as serial correlation or cross autocorrelation. Autocorrelation can be found in cross-sectional and time series data. In cross-sectional data from one region may reflect the characteristics of other similar regions or data from one group of the sample may reflect may similar characteristics of other neighbouring regions or data from one group of the sample may reflect similar characteristics of another group. The problem of autocorrelation does not cause bias in the estimation of coefficients but it reduces a model for forecasting. It leads to increase in the variance of residuals as well as the variance of estimated coefficients in the regression model. Durbin-Watson (d) test the most often test used in the detection of the first order correlation. The d test is considered most powerful test for models based on small samples. For small samples; econometricians suggest that d is greater than d_L and less than 2.5 than accept the null hypothesis P = 0 (Wang and Jain, 2003). Generally, a sample size of fewer than 30 observations is considered as small sample. However, there is no set limit for the large sample size. The Durbin-Watson statistics is between 0 and 4. A value of indicates that no serial autocorrelation problem in the sample. According to (Verbeek, 2008) values nearby zero indicates negative autocorrelation. This study used Durbin-Watson d test to test the null hypothesis framed as that errors are serially uncorrelated against the alternative that they follow a first-order autoregressive process. (Wooldridge, 2006). If the problem of autocorrelation arises in the model. This study used heteroscedasticity and autocorrelation consistent robust standard errors (HAC) errors of white standard errors. Because the HAC errors are consistent for both serial autocorrelation problem and heteroscedasticity problem. However, white's standard error are considered more

consistent with large sample size than small sample. (Gujarati and Sangeetha, 2007) suggest that observation more than 50 may be reasonably large to apply to HAC to correct standard errors. As far as our study is consist of 10 MFIs or samples and total and 76 observations which are large enough to provide unbiased and valid results of regression model while using HAC errors.

3.8.6 Absence of Heteroscedasticity problems

One of the key assumptions of regression analysis is that the variance of the errors is constant across observations. If the errors have constant variance the errors are called homoscedastic. Standard estimation methods are inefficient when the errors have non-variance or heteroscedasticity. In the case of heteroscedasticity, the regression model will provide biased parameter estimates and biased standard errors which ultimately lead to biased in test statistics and confidence intervals. Furthermore, significance statistics may be very high or low depending upon the nature of heteroscedasticity. Generally, white test and Breusch pagan test is used to check for the presence of heteroscedasticity in the model. In this study, white test is applied because it makes no assumptions about the form of heteroscedasticity (white 1980). The White test may be specification errors other than heteroscedasticity. White is preferred over Breusch pagan Godfrey test because white test does no rely on normality assumption and can provide biased estimates if the assumption of normality is not satisfied. Therefore, this study used white test for heteroscedasticity. This study has tested the above mentioned assumptions of regression analysis by using relevant statistical test and arrived at result which is unbiased.

CONCLUSION

To conclude it is found that the present chapter is the backbone of the whole study. It determines the research methodology used to analyse the data. This chapter discusses in detail about the Population and sample design, sources and means of data, research design and conceptual model of panel data. The next chapter has been prepared for an overview of Trends and patterns of sustainability and outreach of Microfinance Institutions in Seemandhra (Andhra Pradesh).

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4.0 INTRODUCTION

This chapter provides an overview of the Microfinance industry in Seemandhra, Andhra Pradesh. This chapter presents the historical background of the microfinance industry in Andhra Pradesh and MFIs models, financial performance and outreach trends of the Microfinance industry of Andhra Pradesh.

4.1 HISTORY OF MFIS IN ANDHRA PRADESH

Microfinance is increasingly being considered as one of the most effective tools for poverty reduction. Poverty is the main cause of concern in improving the economic status of developing countries. A Microfinance Institution is an organization which provides services to a poor section of society. MFIs offers low-income services to poor people trapped in extreme poverty. MFIs in India are operating in different forms i.e. NGO (Non-government organizations), Cooperatives, For profit MFIs and sector of government banks. India's Microfinance sector had come out of age from the early steps taken part of reforms in 1990. While the root of Microfinance is usually traced to the establishment of Shri Mahila Sewa Sehkari Bank (popularly known as SEWA Bank) established in 1974. Mysore resettlement and development Agency (MYRADA) was seen as one of the innovators of the concept of self-help groups (SHG). The concept had emerged in 1984-85, but it was only after the national bank for agricultural and rural development saw the merit in SHG model, it was adopted as a predominant model of achieving financial inclusion by government agencies. In the later part of 1990, a new type of private institutions started growing in India. Most of the MFIs followed classic Grameen model of loan delivery. The earliest to establish operations under this model was SHARE which initially operates as a not for profit NGO, followed by Spandana and SKS. All these microfinance institutions were based in Andhra Pradesh.

4.2 MICROFINANCE POVERTY REDUCTION APPROACHES

MFIs offer various types of financial services to unprivileged and poor section of society. MFIs in India exist in institutional and legal form. As Microfinance is a costly business due to high transaction cost, which means financial self-sufficiency is a big issue for MFIs (Hermes *et. al*. 2011). In 1990, the issue of self-sufficiency of

microfinance institutions gave rise to two opposing approaches but having the same goal i.e. Institutionalist approach and Welfarist Approach (Robinson, 2001). Morduch (2000) refers this controversy as Microfinance Schism.

Institutionalist Approach: The institutional approach emphasises the importance of sustainable microfinance institutions which are not dependent on any subsidy and donations. This approach stresses the importance that MFIs must cover their cost of lending money from self-generated income and to reduce operational cost as much as possible. They emphasize that providing credit in the long term without financial sustainability is not possible.

Welfarist or poverty lending approach: The Welfarist emphasizes that Poor cannot afford higher interest rate. Therefore, providing credit to poor at subsidized rate of interest. Therefore, aiming financial sustainability is contrary to the goal of the serving large no poor clients. The believer of Institutionalist approach emphasizes that empirical evidence neither shows poor cannot afford higher interest rates and nor there is empirical evidence on the negative correlation between Financial Sustainability and Poverty level of clients. They emphasizes that financial services to poor on long term basis is not possible until and unless MFIs are self-reliant and sustainable (Hermes and Lensink, 2011). Most of the parties in this debate favour Institutionalist approach.

Microfinance institutions are constrained to achieve double objective of self-sustainable i.e. covering enough cost so that reliance on subsidy can be overcome and serving unreached poor clients with financial services (outreach). To determine that MFIs are able to meet double challenge of financial sustainability and outreach to poor clients and women borrowers, there is no other alternative but to assess the financial and social performance of MFIs. The evaluation literature on Microfinance is rich but focused on case studies of small no of MFIs. As India's Microfinance sector is rated as one the fastest growing sector in the world. Specifically, Andhra Pradesh is known for Microfinance industry in India.

4.3 ANDHRA PRADESH MICROFINANCE CRISIS

Andhra Pradesh Microfinance crisis can be traced back in the year 2006 when Krishna district government closed down 57 branches of few smaller MFIs. The

reason behind to close down these MFIs came because of the allegations of unethical collections, poor governance unsurious interest rates and profiteering (CGAP, 2010). There was an allegation that ten borrowers of MFIs in Krishna district commit suicide because they were unable to repay the loan taken from MFIs (Shylendra, 2006). Kaur and Dev (2013) mentioned that MFIs had to face the brunt of Act in 2010, for not learning a lesson from 2006 crisis and ignoring all the warnings related to high-interest rates and concentration of the activities in the region. Over-indebtedness in the Andhra Pradesh can be known from the fact in comparison to the national average of 7,700 crores, the average debt outstanding per household was Rs 5,000, (CGAP, 2010). The inability of the borrowers to pay such huge amount resulted in stress on the part of the borrowers and use of coercive methods by MFIs to recover the loan repayments which ultimately lead the borrowers to commit suicide. Government reports the death of 54 customers by suicide. Microfinance crisis 2010 endangered the existence and viability of operations of MFIs in India. Now a day's MFIs are grappling with the issue of their sustainability. Enactment of Andhra Pradesh Microfinance Institutions (regulation of money lending) Acts 2010 stifled the operations of MFIs very badly. After the enactment of Act 2010, provisions related to loan repayment rates fall from 99% to 10% only. The crisis in the Microfinance sector has left MFIs like SHARE, ASMITHA, SPANDANA and FUTURE FINANCIAL SERVICES (FSS) with negative net worth (Business Standard, 13 sept, 2013). Gross loan portfolio reduced by 14 percent in 2011-12 and reduced to Rs 172 billion (Microscape, 2012). Due to rising borrowing cost and inability to raise funds resulted in further straining the operational and financial sustainability of MFIs. According to the state of sector report (2012) out of 61 MFIs studied 11 registered negative returns on assets (ROA). Only 5 MFIs achieved the ROA above 5 percent.

4.4 MFIS MODELS IN INDIA.

A microfinance institution offers various types of financial services to underprivileged and poor section of the society. MFIs in India exist in various institutional forms and legal forms. MFIs are registered under act, 1882; Public Trust Act, 1920; societies registered under societies registration act, 1860; cooperatives registered under mutually aided societies act of the states and Non-banking financial companies

(NBFC) MFIs which are registered under section 25 of the companies act 1956. MFIs in India are registered under different registering authorities. The given below Table 2.1 presents how MFIs are organized under different acts and legal forms in India.

Table 4.1 Microfinance institutions in India.

Sl. No.	Type of MFI	Number	Legal Registration
Not-for-Profit MFIs			
1	NGOs	400-500	Society Registration Act, 1860 Indian Trust Act, 1882
2	Non-Profit companies	20	Section-25 of Indian Companies Act, 1956
Mutual Benefit MFIs			
3	Mutual benefit MFIs – Mutually Aided Cooperative Societies (MACS)	200-250	Mutually Aided Co-operative Societies, Act enacted by State Governments
For Profit MFIs			
4	Non-Banking Financial Companies (NBFCs)	45	Indian companies Act, 1956 Reserve Bank of India Act, 1934

Source: Satish (2005)

4.5 TRENDS OF FINANCIAL PERFORMANCE AND SOCIAL PERFORMANCE OF ANDHRA'S MFIS

According to Meyer and Zeller (2002), Operational Sustainability is the ability of MFI to cover its operational costs from its operating income regardless whether it is subsidised or not. MFIs are considered self-sufficient when institutions can cover its operational or financial costs from their generated business income. According to Woller and Schreiner (2002), MFI self-sufficiency is nonprofit equivalent of profitability. The above definitions of financial sustainability imply that loss-making institutions with poor financial performance would not be classified as financially sustainable. Moreover, profit making MFIs covering some of the operating costs by

subsidized sources or funds will not be considered as financially sustainable. According to Morduch (2000), only 1% of total MFIs are financially self-sustainable.

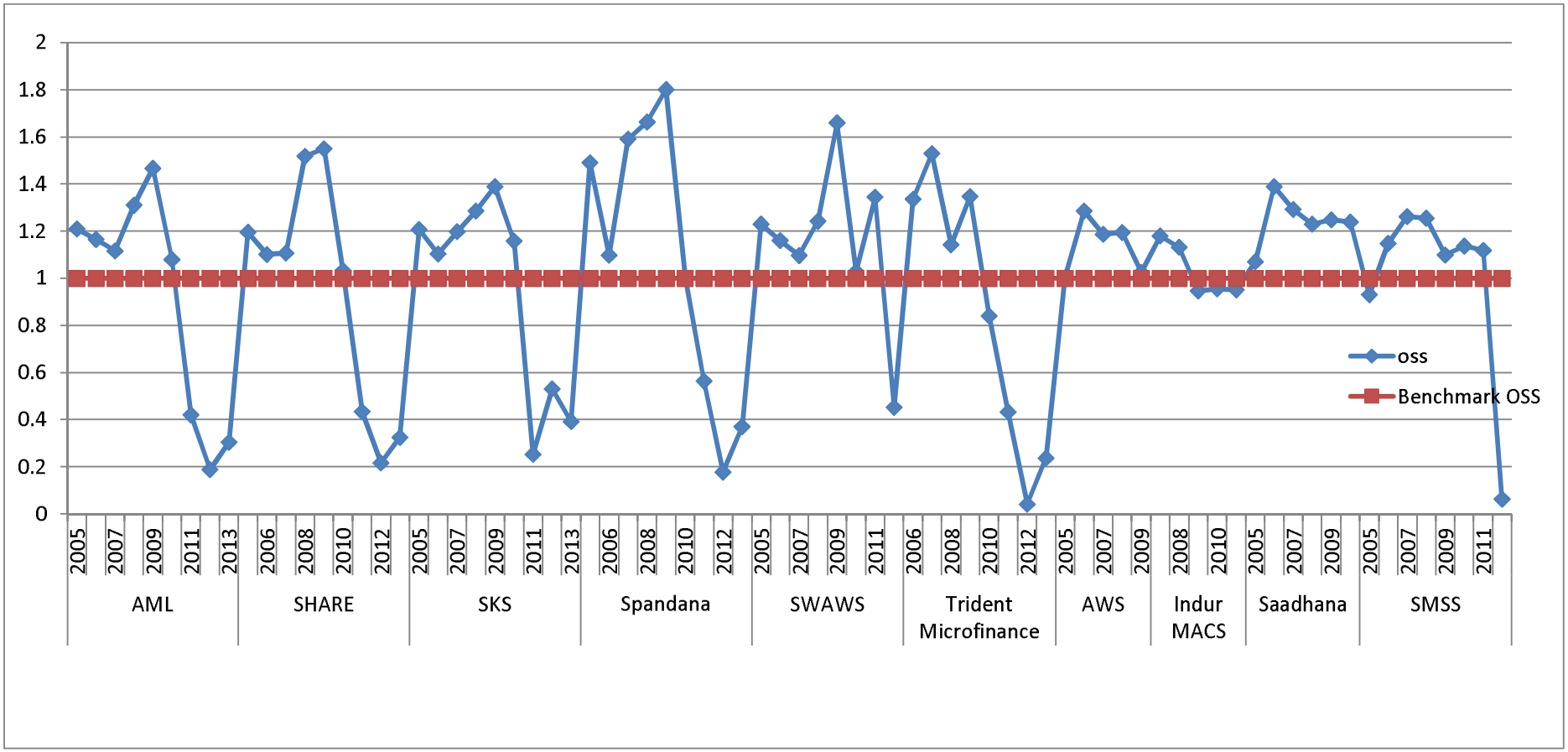
Outreach of MFIs is related to the social performance. It can be defined as the high quality of financial services to destitute. (Gonzalez-Vega, 1998) state that Microfinance program focuses on quality, cost, depth, breadth, length and variety of outreach. Outreach is a social benefit of Microfinance aiming at improving well-being to poor and women clients. Schreiner, 2002 refers that depth of outreach is the value that society attaches to the net gain of a given client. In most studies average loan, size is taken as a proxy of the depth of outreach to poor. Smaller size loans indicate the better depth of outreach. Accordingly, it is considered that core poor are being served by MFIs if average loan size is small and majorities are female clients (Bhatt and Tang, 2001). In literature, there is two common used measure of outreach namely average loan size and average loan size adjusted by GNI per capita. The breadth of outreach involves the number of poor clients reached by an MFI. The length of outreach indicates for how long period target clients are being served with financial services (Gonzalez -Vega, 1998).

4.5.1 Operational self-sufficiency

Financial Sustainability of Microfinance institutions is the key dimension for sustainability of MFIs. It refers to the ability of the MFI to cover all its costs from own generated income from operations without depending on external support. CGAP defines sustainability as the ability of Microfinance provider to cover all of its costs. Financial sustainability can be measured in two stages i.e. operational and financial self-sustainability. The operational self-sufficiency indicates whether revenue is enough to cover the institutional cost. The value of 1 and above for OSS ratio indicates that MFIs are operationally self-sufficient and less than one means that, MFIs are not operationally self-sufficient.

Table 4.2: Constructed from data obtain from MIX over the period (2005-2013) of Andhra's MFIs

Table 4.2: Trend of Operational self-sufficiency (OSS)



Source: Author's computation

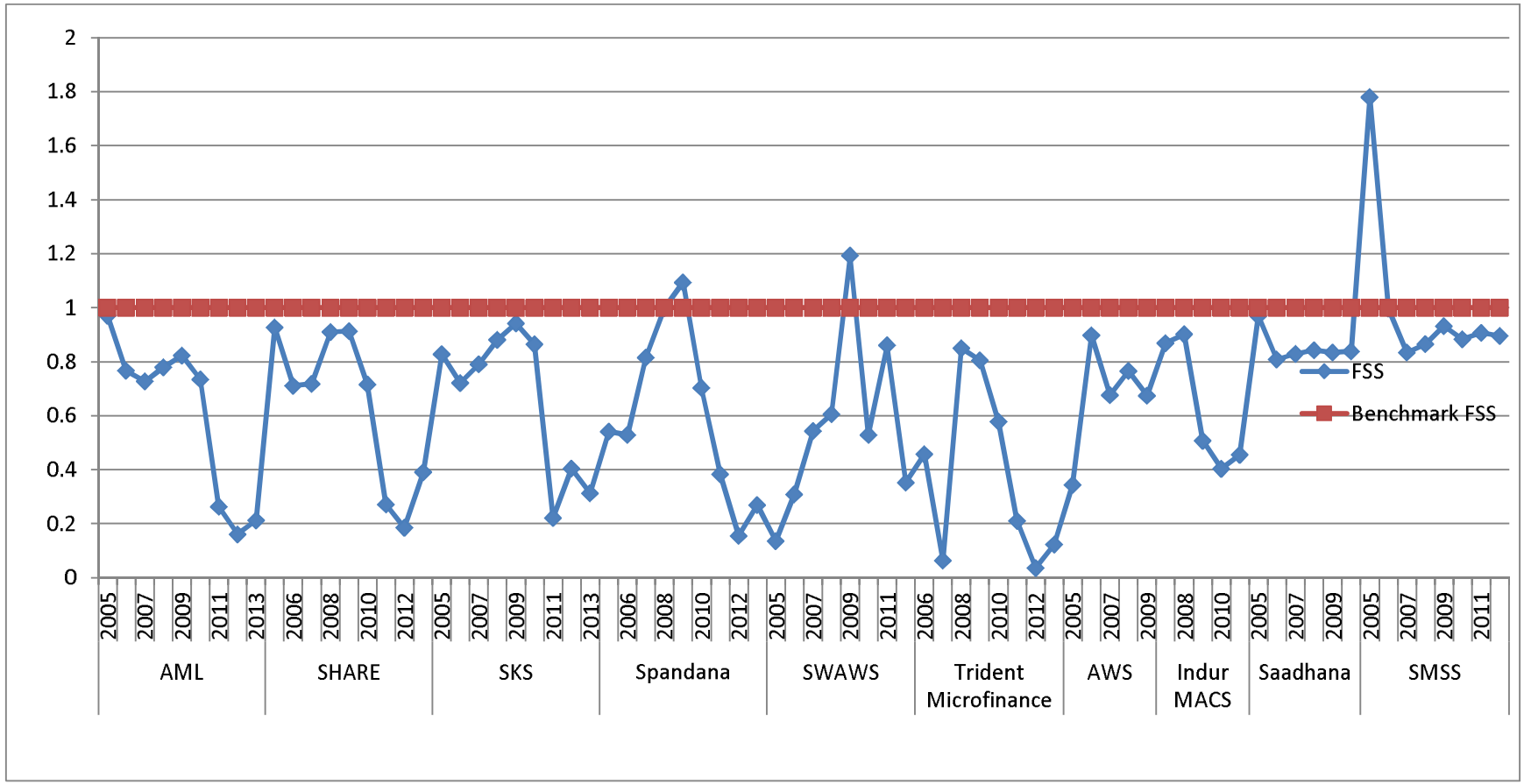
Table 4.2 shows the trend of operational self-sufficiency. Despite some fluctuations, seemandhra's MFIs are operational self-sufficient before the year 2010 as the trend of OSS is above the benchmark i.e. one. After the year 2010, the trend values are below the benchmark line for all the selected MFIs except for AWS, Indur MACs and Saadhna, because MFIs in Andhra Pradesh is very badly affected by Andhra Pradesh Microfinance Crisis 2010. Some of the MFIs do not provide full information to MIX market database, as data of AWS, Indur MACs and saadhna is missing for different years.

4.5.2 Financial self-sufficiency (FSS)

The financial self-sustainability is a ratio which measures the sustainability of MFIs regarding financial self-sufficiency. It is the ratio of adjusted financial revenue divided by the financial and operational expenses as well as adjusted by the loan loss provision and loan adjustments. If FSS value is one or greater than one, it indicates that MFIs are financially self-sustainable. On the other hand, less than one suggests that MFIs are not financially self-sustainable.

Table 4.3: Constructed from data obtain from MIX over the period (2005-2013) of Andhra's MFIs

Table 4.3: Trend of Financial self-sufficiency (FSS)



Source: Author's computation

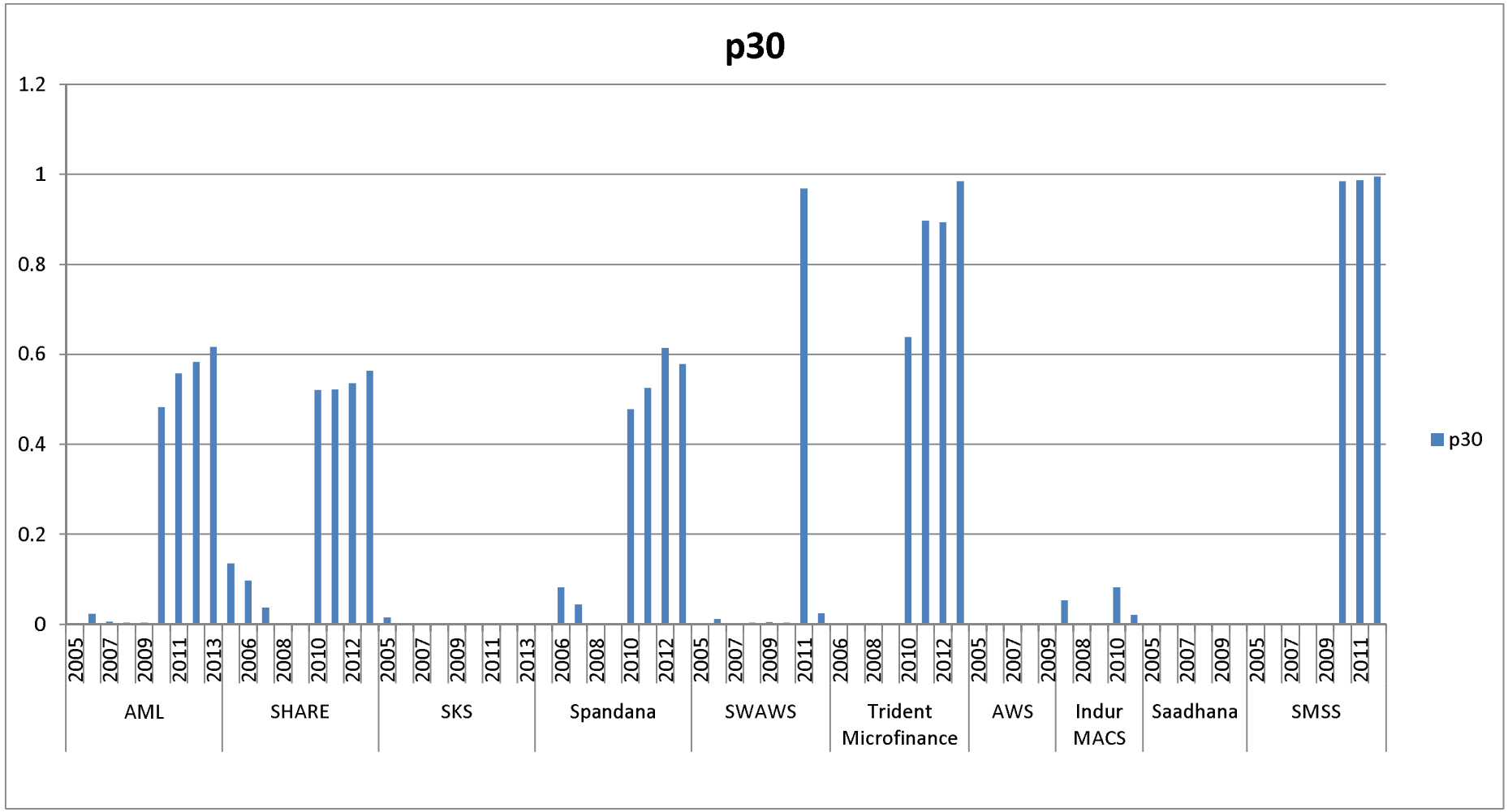
Tables 4.3, shows that trend values of FSS are below the benchmark limit i.e. one. The trend also depicts that FSS is lowest for all the MFIs after the year 2010 because Microfinance industry was badly affected by Andhra Pradesh Microfinance crisis in 2010.

4.5.3 Portfolio at Risk (30) days

Portfolio at risk is a variable which measures the efficiency of MFIs in making collections. The higher the portfolio at risk ratio indicates inefficiency in making collections, an indication of poor repayment of loans and interest. Contrary to this, lower portfolio at risk shows higher repayment rates.

Table 4.4: Constructed from data obtain from MIX over the period (2005-2013) of Andhra's MFIs

Table 4.4: Trend of Portfolio at risk (30) days



Source: Author's computation

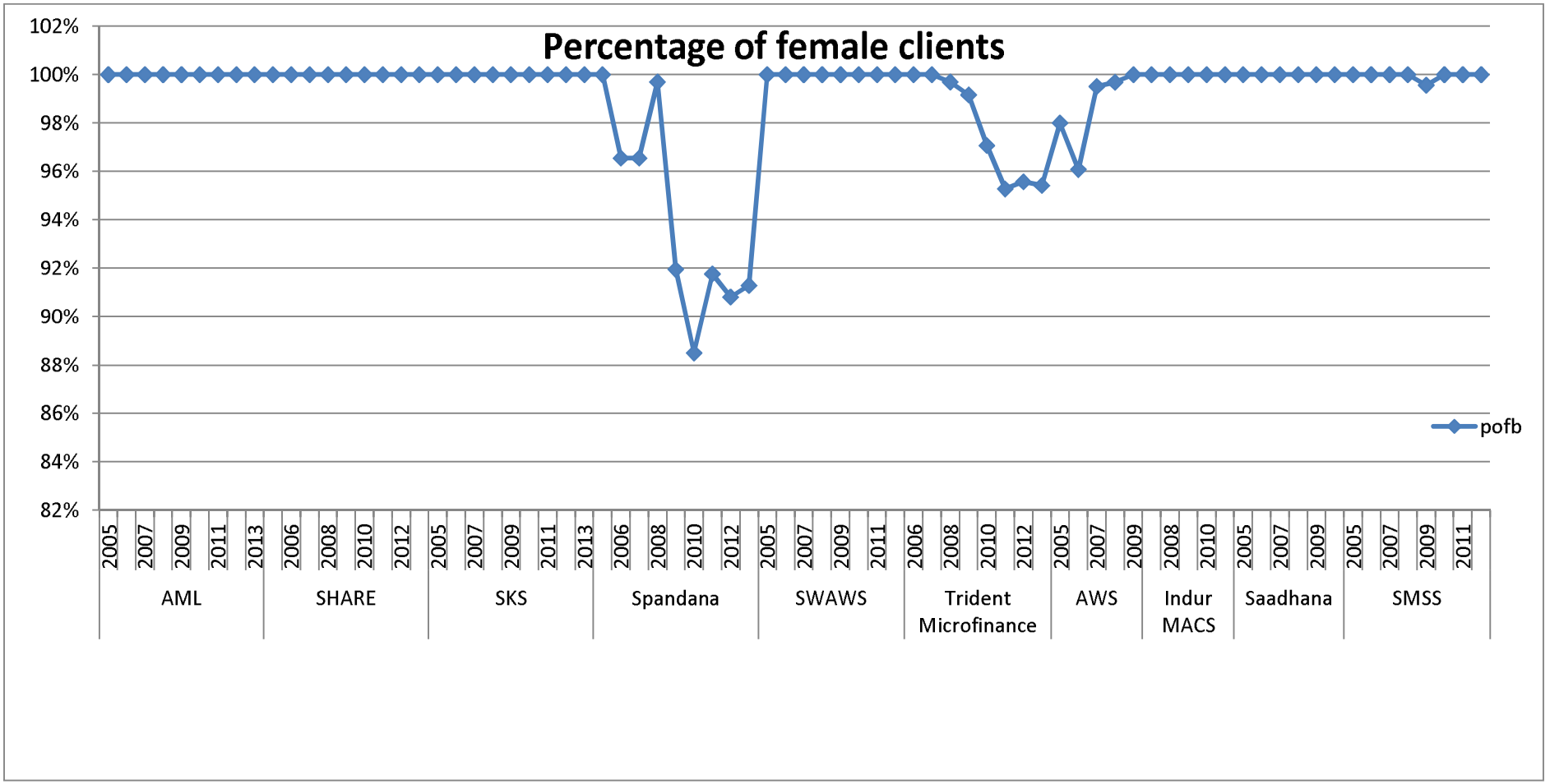
Table 4.4 represents the portfolio at risk over the study period of selected Andhra MFIs. The table represents diversified results for different MFIs as Portfolio at risk is very high for the period 2010 - 2013 for AML, SHARE, Spandana, SWAS, Trident Microfinance and SMSS. Contrary to this SKS and Indur MACs portfolio at risk is very low less than 10%. SKS and Indur MACs seem to be unaffected by the Andhra microfinance crisis. Because of crisis, provisions related to loan repayment rates fall from 99% to 10% only. We can't say confidently about AWS and Sadhana were unaffected by the Andhra Pradesh crisis as data is missing from the year 2010 for both MFIs. However, Portfolio at risk is very low over the given period.

4.5.4 Depth of Outreach to female clients

The depth of outreach is mainly concerned with a microfinance client targeting i.e. poverty targeting- lending to the indigent and poor versus lending to the marginally poor and non-poor; gender targeting - lending to women versus lending to men (Brau and Woller, 2004). The study used percentage share of women borrowers in gross loan portfolio to evaluate the depth of outreach to female clients of Andhra Pradesh MFIs.

Table 4.5: Constructed from data obtain from MIX market over the period (2005-2013) of Andhra's MFIs

Table 4.5: Trend of outreach to female clients



Source: Author's computation

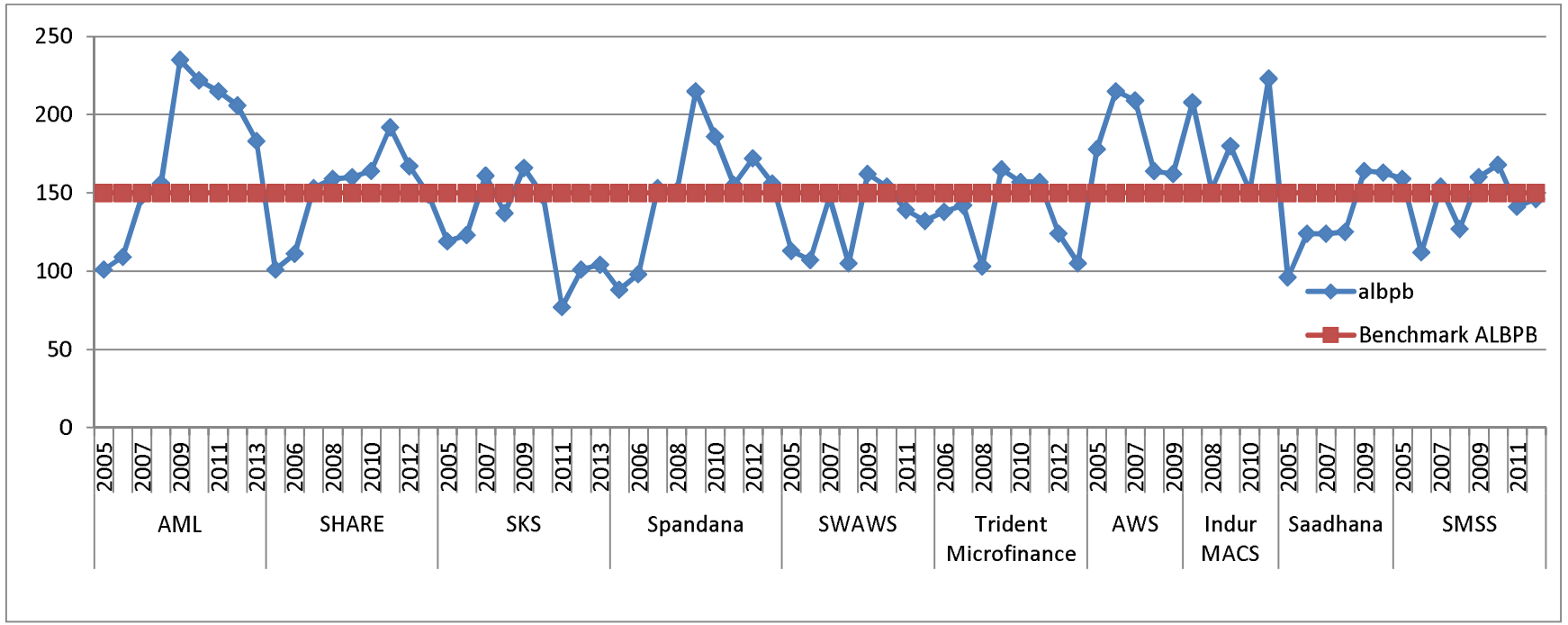
Table 4.5 shows the outreach to female clients of selected Microfinance institutions; trend line illustrates the outreach to women client is as high as 100%, and the minimum is 88%. Most of the MFIs have 100% share of women clients. It is an excellent sign of outreach to women clients and shows MFIs concern towards female borrowers.

4.5.5 Depth of outreach to poor

The depth of outreach to poor is mainly involved with microfinance poor client targeting. This study used average loan size per borrower to evaluate the depth to outreach to poor clients.

Table 4.6: Constructed from data obtain from MIX market over the period (2005-2013) of Andhra's MFIs

Table 4.6: Trend of outreach to poor clients measured by using proxy variable (Average loan balance per borrower)



Source: Author's computation

The average loan size indicates the depth of outreach. The average loan size is used as a measure of the depth of outreach. Smaller amount of loan indicates better outreach to poor. According to UNCDP rough indicator for average loan balance serving the very poor benchmark of 150 USD. The trend revealed diversified results as trend points above the benchmark indicates serving of non-poor clients as average loan size is greater than 150. AML, SHARE, Spandana, AWS and indur MACs average loan size is above the benchmark limit which indicates that these MFIs are not performing better regarding outreach to poor clients. However, SKS, SWAWS, Trident Microfinance, Sadhana and SMSS are performing better regarding outreach to poor clients. Another cause of concern is that with the span of time average loan size is increasing over the period. However, it falls rapidly after 2009, because of Andhra Pradesh Microfinance Crisis.

4.6 CONCLUSION

Microfinance institutions are subjected to achieve double objective of covering enough cost so that reliance on subsidy can be overcome and serving to the unreached poor clients. Microfinance institutions are considered as a tool for sustainable development. Nowadays MFIs are struggling for their sustainability. According to the report of (Deutsche bank, 2007) only 1-2% MFIs are financially sustainable. Mostly larger MFIs are profitable. 70% of all MFIs are heavily dependent on subsidies. Andhra Pradesh microfinance crisis very badly affected the microfinance industry. This chapter has traced out the financial performance and social performance of MFIs in Andhra Pradesh by using different proxy measures of financial and social performance for the period 2005-2013. The study analyzed the trend of financial performance by using Operational self-sufficiency and Financial self-sufficiency and Portfolio at risk (30) days for loan repayment performance. For analyzing the social performance, this study used average loan balance per borrower for depth of outreach to poor clients and percentage share of women clients for outreach to women clients. The trend of the operational self-sufficiency of seemandhra's MFIs revealed that MFIs are operational self-sufficient before the year 2010. The trend of financial self-sufficiency shows that seemandhra's MFIs are not financially self-sufficient. The trend of the portfolio at risk depicts that portfolio at

risk is very high from the year 2010 because loan repayment falls from 90% to 10% because of Andhra crisis. However, the trend of outreach to female clients shows of the very good sign of outreach to female clients. Outreach is as high as 100% for most of the seemandhra's MFIs. However, SKS, SWAWS, Trident Microfinance, Sadhana and SMSS are performing better regarding outreach to poor clients. The next chapter discusses in detail about the result and discussions of models related to financial self-sufficiency, operational self-sufficiency, portfolio at risk and trade off between sustainability and outreach to poor and women clients.

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5.0 INTRODUCTION

This chapter shows the overall results of determinants of financial self-sufficiency, operational self-sufficiency, portfolio at risk, depth of outreach to female clients and poor and the tradeoff between outreach and sustainability. The present chapter is divided into five sections. Section **5.1** states about descriptive statistics of dependent and independent variables used in the study. Section **5.2** discusses the test and techniques used to satisfy the assumptions of multiple regression analysis. Section **5.3** discusses the selection criteria of the most appropriate model out of the Pooled OLS, Fixed effect and Random effect models of panel data. Section **5.4** depicts results of pooled OLS, Random effect and fixed effect models for FSS, OSS, P30, POFB & ALBPBG models. Section **5.5** is about the findings and discussion of various models used in the study. Finally, section **5.6** is about the conclusion of this chapter.

5.1 DESCRIPTIVE STATISTICS

Table **5.0** provides the descriptive statistics of all the variables used in the study over the period 2005-2013. All the dependent and independent variables have 76 observations in total. The measure or proxy for the size of microfinance institutions is the total assets and average loan balance per borrower is a measure for depth of outreach. Total assets and average loan balance per borrower are transformed into natural logarithm form.

Table 5.0: Descriptive statistics of dependent and independent variable

Descriptive Statistics of Dependent and Independent variables					
Variable	**Mean**	**Standard deviation**	**Minimum**	**Maximum**	**No. of Observations**
FSS	0.657846	0.313578	0.0360245	1.78001	76
Oss	1.01925	0.422616	0.0415000	1.80040	76
albpbg	0.135682	0.0377198	0.0520000	0.253200	76
Yogp	0.109191	0.197436	0.130400	0.995400	76
Ccta	0.0705189	0.0574553	0.000800000	0.365500	76
Glpta	1.11314	0.997195	0.652800	8.91600	76
Pofb	0.989755	0.0250685	0.884900	1.00000	76
p30	0.192328	0.320923	0.000000	0.995400	76

Pea	0.0471257	0.0163077	0.0165000	0.0917000	76
l_ass	17.3295	1.99854	13.9942	20.6751	76
AGE	15.5263	5.37767	4.00000	27.0000	76
l_albpb	4.98210	0.241976	4.34381	5.45959	76
Albpb	149.947	35.3323	77.0000	235.000	76

Note: Fss = financial self-sufficiency ratio, Oss = Operational self-sufficiency ratio, Albpbg = Average loan balance per borrower to gni per capita, Yogp = yield on gross loan portfolio to total assets ratio, Ccta = Capital cost to total assets ratio, Glpta = gross loan portfolio to total assets ratio, Pofb = Percentage of female borrowers, P30 = Portfolio at risk (30) days, Pea = Labour cost to total assets ratio, l_ass = Log of total assets (size), AGE = age of MFIs since its establishment, l_albpb = log of average loan balance per borrower, Albpb = Average loan balance per borrower

5.1.1 Financial self-sufficiency

The financial self-sustainability is a ratio which measures the sustainability of MFIs regarding financial self-sufficiency. It is the ratio of adjusted financial revenue divided by the financial and operational expenses as well as adjusted by the loan loss provision and loan adjustments. If FSS value is one or greater than one, it indicates that MFIs are financially self-sustainable. On the other hand, less than one indicates that MFIs are not financially self-sustainable. As per the result of descriptive statistics for FSS, the mean value is 0.657 (65.7%) which indicates that MFIs in the sample are not financially self-sufficient. This ratio is below the standard benchmarking i.e. MFI is considered sustainable if the FSS ratio is one or above. The standard deviation of FSS is 0.31. Total observations are 76 out of which 45 (59%) indicated sustainable MFIs and remaining 31 observations (41%) MFIs are not financially sustainable. The long-term provision of financial services is undermined by the continued necessity to rely on donor's fund. To provide financial services to poor for a longer period, MFIs must become financially self-sustainable.

5.1.2 Operational self-sufficiency

The operational self-sufficiency indicates the sufficiency of operating income to cover operational costs like salaries, suppliers, loan losses and other administrative costs. As per result of descriptive statistics in Table **5.0** the mean of operational self-sufficiency

is 1.019 (101.9%) indicating that MFIs are operationally self-sufficient. The value of 1 and above for OSS ratio indicates that MFIs are operationally self-sufficient and less than one means that, MFIs are not operationally self-sufficient. As the mean value is just above the threshold limit. Therefore, it can be inferred that sample MFIs are operationally self-sufficient. The standard deviation for OSS is 0.42. The total number of observation available from the data are 76 out of which 34 (45%) indicated that MFIs are operationally self-sufficient and remaining 42 observations indicated that (55%) MFIs are not operationally self-sufficient. The minimum value for OSS ratio is 0.04, and the maximum value is 1.08 As the dispersion values of operational sustainability reflects a higher dispersion in the data thus indicating greater variability in data. An operational self-sufficiency of 1 (100%) in the first stage signify that the institutions in its way to achieving long-term operational self-sufficiency.

5.1.3 AGE

Age indicates the time duration since the MFIs have been providing financial services. It represents the number of years since it came into existence. As per the descriptive statistics in Table **5.0,** the mean value of the age is 15.5 years (15 years and five months in real terms) on average. It indicates that sample MFIs are young regarding age. The Maximum value of variable age is 27 and minimum is 4. It indicates that older MFIs have been operating in Andhra from many years. Minimum value indicates that some new MFIs recently entered into the business. Moreover, the variability in data is lower as the value of standard deviation is quite lower than the mean value. Therefore, the spread of data is normal.

5.1.4 Average loan balance per borrower

The average loan size indicates the depth of outreach. The average loan size is generally used as a measure of the depth of outreach. Smaller amount of loan indicates better outreach to poor. The descriptive statistics for the mean value of average loan size per borrower is 4.98 in its natural logarithm value. In real term, the value for the mean is (149.94$) indicating that MFIs provide (150$) per borrower. The maximum value of loan balance per borrower is (235$). It is an indication of serving non-poor clients. However, the minimum value of (77$) is an indication of better outreach to poor.

5.1.5 Yield on gross loan portfolio

Yield on gross loan portfolio measures how much earning received as interest income from its client during the year. It shows the average gross returns as a proportion of portfolio outstanding. It indicates the efficiency by which an MFI utilized its resources in generating cash revenue. The higher the ratio indicates better microfinance efficiency. The variability in yield on gross loan portfolio is higher because the value of standard deviation is higher than its mean value. Fluctuation in growth on gross loan portfolio is significant with high as much as (99.54%) and a low of (13.04%). This reflects a higher dispersion in data thus indicating greater variability in data.

5.1.6 Capital cost to assets ratio

Capital cost to assets ratio is the ratio of adjusted total equity to adjusted total assets. It is a very commonly used measure of financing structure. The capital cost to assets ratio has an average value of (0.070). It means that around 7% of equity financing is done against total assets by microfinance institutions. The capital cost to assets ratio of sample firms or MFIs has a standard deviation lower than the mean value, thus the spread of data is normal. Furthermore, the minimum value is 0.0008 and maximum value is 0.365. It indicates that proportion of equity financing is quite low against the total assets.

5.1.7 Gross loan portfolio to total assets ratio

Gross loan portfolio to total assets ratio an indication of their focus on lending otherwise their finds have utilized for some other income generating purpose. It is used as a measure of the risk exposure of MFIs. The descriptive statistics in table **5.0** shows that mean value is 1.113. The ratio of the gross loan portfolio to total assets of sample firms or MFIs has standard deviation of (0.99). These figures clearly indicate that variability in data is low as standard deviation value is lower than the mean value indicating that spread of data is normal. Furthermore, the difference between the minimum and maximum value reflects higher dispersion in the data thus indicating greater variability.

5.1.8 Percentage of female borrowers

The percentage of female borrowers is very commonly used indicator of depth of outreach. As per result of descriptive statistics in table **5.0** the mean value is (0.989).

It means that percentage of loan given to women clients is 98.9% which indicate very high level of outreach of Andhra MFIs to female clients. The value of standard deviation is 0.02 which is quite lower than the mean value indicating that spread of data is normal. Moreover, difference between minimum value of (0.88) and maximum value of 1 reveals low level of dispersion thus indicating lower variability in data. It also indicates that the entire sample MFIs performs better in terms of outreach.

5.1.9 Portfolio at risk (30 days)

Portfolio at risk is a variable which measures the efficiency of MFIs in making collections. The higher the portfolio at risk ratio indicates inefficiency in making collections, an indication of poor repayment of loans and interest. Contrary to this, lower portfolio at risk indicates higher repayment rates. Fluctuations in portfolio at risk are significant with high up to (0.995) 99.5% and as low of 0.0%. This finding reflects a higher dispersion in the data thus indicating greater variability in data. It indicates that some MFIs portfolio at risk is 0.00% which indicates 100% collections. On the other side maximum value is 0.99 which indicates that for some MFIs portfolio at risk is very high. It is the repercussion of Andhra microfinance crisis 2010. As higher ratio means lower collections rate, thereby inefficient MFIs.

5.1.10 Log Assets

The mean value of size measured by total assets is (17.32). The variability in data is normal because the value of standard deviation is 1.998 which is quite lower than the mean value. The minimum value of log assets is (13.99) and maximum value is (20.67). Difference between minimum value and maximum value is not huge which reflects a lower dispersion in the data and thus indicating lower variability in data.

5.1.11 Labour cost to assets ratio

The descriptive statistics of labour cost to assets ratio revealed that standard deviation value (0.01) is smaller than the mean value (0.04). Hence, the spread of data is normal. The maximum value for labour cost to assets ratio is 0.09 and minimum value is 0.01. Difference between Minimum and maximum values also reflect marginal increment in labour cost during the reference period.

5.2 PRE-TESTING RESULTS

This study employed models of panel data i.e. Pooled OLS model, fixed effect and random effect model to check the consistency of result. Though, result and

interpretation are based on the most appropriate model. Most appropriate model is selected on the basis of results of F-test, Breusch pagan test and Hausman test. The result of these tests is generated by using Gretl version- 1.9.12. For the models of multiple regression analysis, it is compulsory to satisfy the assumptions of regression analysis to obtain unbiased results. All the models have been tested for the assumptions of the regression model before interpreting the result. These tests are indicated under the following sections.

5.2.1 Normality

To test the normality of data is the preliminary assumption of regression analysis technique. Therefore, the assumption of normality is conducted through Shapiro-Wilson test and Kolmogorov- Smirnov test. The result of both tests is shown in Appendix (A). The results of Shapiro Wilkson and Kolmogorov- Smirnov test reflect that p-value is under (0.05) for all the variables except age. This is the evidence that all the variables follow not normal distribution except for age. In the case of age, the p-value is more than (0.05). Hence the variable age follows normal distribution. In fact, non-normality is very common phenomenon while using financial and economic data. It is impossible to have perfect normal data. There are various technique prescribed by researchers and econometricians through which data could transform towards normality. Although, it is not necessary that transformation techniques could transform towards perfect normality. In econometrics literature, variable transformation technique is suggested by the (Hair *et. al.*, 2006; Wooldridge, 2006; Verbeek, 2004; Cameron and Trivedi, 2009). To remedy this problem, the study used log transformation technique to transform variables into its natural logarithm. The data contains negative and zero values, it is considered better to use log transformation technique. Although, after transformation of variables into its natural logarithm, most of the variables could not transform towards normality. The results of Q-Q plots in Appendix (B) show that only two variables average loan balance per borrower and size of MFIs measured by the log of assets inclined towards normality after log transformation. As most of the variables follow non-normal distribution because the data points are away from the best fit line. These points which are scattered away from the best fit line are known as outliers. These outliers are responsible for non-normality of data. Furthermore, it is also to be noted that as long

as the sample is based on 30 or more observation, the sample distribution of mean can be safely assumed to be normal (Mordkoff, 2011). The sample size of this study falls above the prescribed limit of central limit theorem i.e. 10 Firms or MFIs and 76 observations. Therefore, the study considers log transformation only for size and average loan balance per borrower which inclined towards improvement in normality and continue with same data and interpret the result cautiously.

5.2.2 Correlation Analysis

Before applying regression analysis technique, the multicollinearity between different dependent variables with independent variables is detected as reported in the table (5.1). The analysis was meant to check the problem that variables are correlated or not. If variables were not correlated then using several simple regression variables or one each multiple regression models would provide similar results (Dougherty, 2007). Correlation analysis determines the problem of multicollinearity. If variables are correlated, regression provides biased result i.e. which are not accurate. The overall results of correlation analysis revealed that only few variables are highly correlated.

The problem of multicollinearity arises when there is high, but not perfect correlation between two or more explanatory variables. (Cameron and Trivedi, 2009; Wooldridge, 2006; Churchill and Iacobucci, 2005) reported that multicollinearity between explanatory variables reduces the efficiency of estimates. Another effect of multicollinearity is that small change in data causes wide swing in parameter estimates. However, multicollinearity tolerable limit is not well defined. Kennedy (2008) and Wooldridge (2006) suggest that there is no absolute correlation limit on the basis of which it can be concluded multicollinearity is a problem. He suggested that problem of multicollinearity arises if the total sample variation (SST) and the variance square of the respective variable are highly correlated. Hair *et. al.* (2006) reports that correlation coefficient (0.9) is acceptable and may not cause multicollinearity problem. Moreover, Kennedy (2008) suggests that correlation coefficient below 0.7 may not cause multicollinearity and coefficient above 0.7 lead to multicollinearity. Table **5.1** provides the result of multicollinearity between dependent and independent variables.

Multicollinearity results

Table 5.1

	AGE	ALBPBG	CCTA	FSS	GLPTA	L_ALBPBG	L_ASS	OSS	P30	PEA	POFB	YOGP
AGE	1.000000											
ALBPBG	-0.322591	1.000000										
CCTA	-0.307700	-0.029553	1.000000									
FSS	-0.320142	0.425566	0.035301	1.000000								
GLPTA	0.222750	-0.280857	-0.177300	-0.378078	1.000000							
L_ALBPB	0.053976	0.552474	0.110357	0.070101	-0.086268	1.000000						
L_ASS	0.732431	-0.149228	-0.332760	-0.057287	-0.070579	0.086663	1.000000					
OSS	-0.381355	0.498320	0.108037	0.634343	-0.449989	0.032961	-0.068176	1.000000				
P30	0.284837	-0.419544	-0.210149	-0.343068	0.457572	0.164520	0.040008	-0.602082	1.000000			
PEA	0.240223	-0.411971	0.212528	0.061753	-0.232894	-0.440921	0.254694	0.061033	-0.238409	1.000000		
POFB	-0.412465	0.030073	0.192594	0.221467	-0.283494	-0.174970	-0.240428	0.233099	-0.344459	0.147586	1.000000	
YOGP	0.025384	-0.112341	-0.008245	0.246520	-0.114738	-0.023013	-0.064413	0.101027	0.322258	0.223271	0.149894	1.000000

Source: Gretl output

Note: FSS = financial self-sufficiency ratio, OSS = Operational self-sufficiency ratio, Albpbg = Average loan balance per borrower to gni per capita, Yogp = yield on gross loan portfolio to total assets ratio, Ccta = Capital cost to total assets ratio, Glpta = gross loan portfolio to total assets ratio, Pofb = Percentage of female borrowers, P30 = Portfolio at risk (30) days, Pea = Labour cost to total assets ratio, I_ass = Log of total assets (size), AGE = age of MFIs since its establishment, l_albpb = log of average loan balance per borrower, Albpb = Average loan balance per borrower

The result of the pairwise correlation is reported in table no. (5.1). The results of correlation analysis show that all the variables except age and (l_ass) are below the threshold limit of (0.7). The result revealed that the variable age is highly correlated with size at (0.73). The study further computed variance inflation factor (VIF) for each coefficient to detect the culprit variable causing multicollinearity. Gujarati (2003) and Hair *et. al.* (2006) suggest that variance inflation factor above 10 causes multicollinearity. Following the Hair *et. al.* (2006) criteria of VIF. The results of variance inflation factor of all models are reported in Appendix (C), Table 1-5. The VIF values of independent variables in all the models ranges from 1 to 3 i.e. within the threshold which point toward nonexistence of multicollinearity. It implies that regression coefficient will be fairly estimating the model.

5.2.3 Heteroscedasticity Results

5.2.3.1 Heteroscedasticity results of pooled OLS models

The study further tested heteroscedasticity by applying white's General heteroscedasticity test on the respective pooled OLS models incorporating firm-specific variables as result shown in Appendix (D), Table 1-5. According to acceptance criteria of white's test. If the corresponding p-value is less than 0.05 (i.e. less than 5% level of significance). Therefore, the null hypothesis articulated as homoscedasticity or constant variance is rejected and the alternative hypothesis there is heteroscedasticity is accepted. The results of Appendix (D), Table 2, 3 & 4 indicates the presence of heteroscedasticity in OSS, P30 and POFB model as the corresponding P value in models are less than (0.05). However, in the case of FSS and ALBPBG model results reported in Appendix (D), table 1 & 5 corresponding P value is more than the 0.05 which indicates homoscedasticity or constant variance in the model. Hence in case of presence of heteroscedasticity in the respective models, Arellano's (1987) correction error for heteroscedasticity has been followed.

5.2.3.2 Heteroscedasticity result of fixed effect models

The presence of Heteroscedasticity is tested by applying wald test for heteroscedasticity in respective fixed effect models. The result of Wald test for heteroscedasticity is presented in Appendix (E), Table 1-5. According to the acceptance criteria of wald test, if the P value is less than (0.05) i.e. less than 5 % level of significance). Therefore, the null hypothesis that there is constant variance is

rejected and the alternative hypothesis that there is heteroscedasticity is accepted. The result of Appendix (E), Table 1, 2, 3, 4 & 5 indicates the presence of heteroscedasticity in all the models as a corresponding P value of is less than (0.05) in respective fixed effect models. Therefore the null hypothesis articulated there is constant variance is rejected and the alternative hypothesis that there is the presence of heteroscedasticity is accepted. Hence, Arellano's (1987) correction for heteroscedasticity (HAC) errors has been used in the respective fixed effect models.

5.2.4 Autocorrelation results by Durbin-Watson test

5.2.4.1 Results of Durbin-Watson test in pooled OLS model

The problem of autocorrelation is tested by using Durbin-Watson test in respective models of pooled OLS regression. The results of Durbin-Watson test are shown in Appendix (F), Table 1-5. If the d statistic higher than the upper bound $(d_U)^4$, i.e., 1.898. It indicates that there exists no positive correlation among errors. Although if the d statistics is below the lower limit (d_L = 1.462). It indicates the presence of positive serial autocorrelation among standard errors. The results of Durbin-Watson test indicate the presence of positive serial autocorrelation in Fss, P30, albpbg and pofb models as the d-statistics is below from the lower bound (d_L= 1.462). Therefore, the null hypothesis framed as no serial autocorrelation stands rejected. Hence, Arellano's (1987) or heteroscedasticity and autocorrelation consistent errors are followed in the respective models where the problem of autocorrelation arises. Thus by using HAC errors, the study can consider all the models free from heteroscedasticity and autocorrelation problem and interpret the result on the basis of t, F and X^2 values.

5.2.4.2 Results of Durbin-Watson test in fixed effect models

The results of Durbin-Watson test for all the respective models of the fixed effect model are shown in Appendix (G), Table 1-5. The results of Durbin-Watson test in Appendix (G), Table 1 & 4 indicate the presence of positive serial autocorrelation in Fss and pofb models as d statistic is less than the lower bound (d_L) i.e. (d_L= 1.462). Thus, the null hypothesis of there is no serial autocorrelation stands rejected in Fss and Pofb models. However, in the case of P30 model, the result of Durbin-Watson test reported in Appendix (G), (Table 3) indicates d statistic i.e. (1.94) is higher than

the upper bound (d_u) value of 1.898. Thus, the null hypothesis articulated as there is no serial correlation stand accepted in P30 model.

Moreover, the result of Durbin-Watson test is inconclusive, in the case of albpbg & oss models, result reported in Appendix (G), (Table 2 & 5) as d statistic value lies between the lower bound and upper bound limit. Therefore, Arellano's (1987) or (HAC) heteroscedasticity and autocorrelation consistent errors are employed in the respective models in which the problem of positive correlation arises. Thus by using HAC errors, the study can consider all the models free from heteroscedasticity and autocorrelation problem and interpret the result on the basis of t, F and X^2 values.

5.3 PANEL DIAGNOSTICS TEST

The panel diagnostic test is employed on FSS, OSS, P30, POFB and ALBPBG models respectively in order to select most appropriate model in "Gretl" software. The results of the panel diagnostic command are presented in Appendix (H), Table 1-5. In order to determine most appropriate model F test, Breusch Pagan test or LM test and finally Hausman test is conducted. F test is conducted to choose between pooled OLS and fixed effect model. Bresch pagan test is conducted to choice between pooled regression and random effect model. Finally, Hausman's specification test is conducted to make choice between pooled regression and random effect model.

First of all choice between pooled OLS and fixed effects model pertaining to FSS model is performed through F test. The Null hypothesis for this test is articulated as pooled OLS model is appropriate and consistent as compared through as the pooled OLS model is appropriate and consistent as compared to fixed effect model. The result in Appendix H, (Table 1) of panel diagnostic command for FSS model shows that the F-statistic value is 3.03 with P value (0.004) a low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favour of the fixed effects alternative. Secondly, Breusch Pagan test is applied on FSS model in order to decide between pooled regression and random effects model. The LM statistic value is 2.18 with P value 0.139. As the P-value is much greater than the 5 % level of significance. Therefore, Null hypothesis articulated as pooled regression is more consistent and appropriate than the random effects model remains accepted. Finally, the choice between fixed effects and random effects tested through Hausman's specification test.

The null hypothesis is framed as the random effect is more appropriate and consistent with fixed effects model. The result of Hausman test in Appendix (H) Table 1 for FSS model indicates that the low p-value of 0.03 is much less than the 5% level of significance. A low p-value counts against the random effects model is consistent, in favour of the fixed effect model. Hence, fixed effect is more consistent than the random effects model.

Thus based on the panel diagnostic test in case of fss model. The results indicate that fixed effect model is more appropriate than pooled OLS and Random effect model. Therefore the interpretation of result for FSS model is based on the fixed effects model.

Similarly, the result of panel diagnostic in Appendix (H), (Table 2) for Oss model proved that fixed effect model is more appropriate than pooled OLS model and random effect model. Therefore, the interpretations of result for Oss model are based on the fixed effect model.

Similarly in case of P30 model result reported in Appendix (H), (Table 3). The results confirm that pooled OLS model is more appropriate than other two models. Therefore, the interpretations of result for P30 model are based on pooled OLS model.

Furthermore, in the case of POFB model, the panel diagnostic test in Appendix (H), (Table 4) confirms that pooled OLS model is more appropriate and consistent than the fixed effect and random effect model. Therefore, the interpretations of results for POFB model are based on pooled ols model. Moreover, in the case of albpbg model, the panel diagnostic test in Appendix (H), (Table 5) confirms that random effect model is more appropriate and consistent than the pooled OLS model and fixed effects model. Therefore the interpretation of results in the case of albpbg model is based on random effect model.

5.4 RESULTS OF POOLED OLS, RANDOM EFFECT AND FIXED EFFECT MODELS FOR EACH MODEL

5.4.1 Results of Financial self-sufficiency (FSS) model by Pooled OLS model, fixed effect model and Random effect regression models.

This section shows the result of factors affecting financial self-sufficiency model by pooled OLS model, random effect model and fixed effect model. In order to check

consistency all the three models (Pooled, Fixed effect and Random effect) of panel data are employed. Finally, results and interpretation are based on a most appropriate model which is chosen on the basis of the result of F test to make choice between pooled OLS and fixed effect model, Breusch pagan test to make choice between pooled OLS and random effect model. Finally, Hausman test to make choice between random and fixed effect model.

Operational Model for FSS

$$(FSS)_{i,t} = \alpha_i + \beta_1 (YOGP)_{i,t} + \beta_2 (CCTA)_{i,t} + \beta_3 (GLPTA)_{i,t} + \beta_4 (L\_ALBPB)_{i,t} + \beta_5 (P30)_{i,t} + \beta_6 (PEA)_{i,t} + \beta_7 (L\_ASS)_{i,t} + \beta_8 (AGE)_{i,t} + \varepsilon_{i,t}$$

5.4.1.0 Summary of panel data

This section shows the coefficients of econometric regressions by pooled, fixed and random to facilitate an overall overview. Table **5.2** shows panel data regression for the year 2005-2013 with financial self-sufficiency as the dependent variable. The table reports summary of pooled OLS, fixed effect and random effect model of financial self-sufficiency (FSS) on (glpta), yield on gross loan portfolio (yogp), capital cost to assets (ccta), gross loan portfolio to total assets (glpta), average loan balance per borrower (albpb), portfolio at risk (30) days (p30), labour cost to assets (pea), size of mfi, Assets (ass), age of mfis in years (AGE) .

Table **(5.2)** shows the results from pooled, fixed, and random models. The dependent variable is the financial self-sufficiency. According to the result of panel diagnostic command fixed effect model is more appropriate and consistent than Pooled OLS and Random effect model. *,**,*** significant at 10%, 5% and 1% level respectively. Figures that are in bold are p values. Figures in parenthesis are t values based on Robust (HAC) standard errors. Figures in brackets are coefficients.

Table 5.2 Model 1: Dependent variable: Financial self sufficiency

Included 10 cross-sectional units

Time-series length: minimum 5, maximum

Robust (HAC) standard error

Variables	**Pooled OLS regression model**	**Fixed effect regression model**	**Random effects regression**
Const	(-0.172192) [-0.0643] **0.94891**	(-0.499381) [-0.5390] **0.59194**	(-0.172192) [-0.2207] **0.82599**
YOGP	(0.541798)	(0.451348)	(0.541798)

	[3.2606] **0.00175*** **	[2.3153] **0.02415** **	[3.1016] **0.00282*** **
CCTA	(-0.71581) [-0.7853] **0.43502**	(-0.476002) [-0.5966] **0.55311**	(-0.71581) [-1.0325] **0.30557**
GLPTA	(-0.00126836) [-0.4954] **0.62196**	(0.0310568) [0.7628] **0.44870**	(-0.00126836) [-0.0345] **0.97259**
L-ALBPB	(0.212125) [1.2702] **0.20840**	(0.130244) [0.6904] **0.49269**	(0.212125) [1.3699] **0.17529**
P30	(-0.370474) [-2.0084] **0.04864** **	(-0.336808) [-2.0049] **0.04965** **	(-0.370474) -2.9955 **0.00384*** **
PEA	(-0.736011) [-0.0853] **0.93225**	(-1.08831) [-0.3375] **0.73694**	(-0.736011) [-0.2716] **0.78674**
L_ASS	(0.0603387) [0.8008] **0.00125*** **	0.145989 [2.8237] **0.00650*** **	(0.0603387) [2.0243] **0.04693** **
AGE	(-0.438934) [5.8795] **0.00001*** **	(-0.731365) [-2.7452] **0.00804*** **	(-0.438934) [-2.9228] **0.00473*** **
R^2	**0.385346**	**0.582250**	**0.388844**
Adjusted R^2	**0.311955**	**0.459806**	**0.315870**
F-statistic	**5.250555**	**4.755233**	**5.328531**
P – value (F)	**0.000041**	**3.86e-06**	**0.000035**
Durban-Watson	**1.427617**	**1.437774**	**1.655338**

Source: Gretl. Output

The present study employed pooled OLS model, fixed effect model and Random effect model of panel data in order to check the consistency of results. Though, results and interpretation are based on a most appropriate model which is determined on basis of result of F test, Breusch-pagan test and Hausman test. The result in Appendix (H), Table 1 of panel diagnostic command for FSS model shows that the F-statistic value is 3.03 with P value is (0.004) a low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favour of the fixed effects alternative. Secondly, Breusch-Pagan test is applied on FSS model in order to decide between pooled regression and random effects model. The LM statistic value is 2.18 with P value 0.139. As the P-value is much greater than the 5 % level of significance. Therefore, null hypothesis articulated as pooled regression is more consistent and

appropriate than the random effects model remains accepted. Finally, the choice between fixed effects and random effects tested through Hausman's specification test. The null hypothesis is framed as the random effect is more appropriate and consistent with fixed effects model. The result of Hausman test in Appendix (H), Table 1 for FSS model indicates that the low p-value of 0.03 is much less than the 5% level of significance. A low p-value counts against the random effects model is consistent, in favour of the fixed effect model. Hence, fixed effect is more consistent than the random effects model. The results designate that fixed effect model is more appropriate than pooled OLS and Random effect model. Therefore results and interpretation for financial self-sufficiency (FSS) model are based on the fixed effects model which is discussed in detail in section **5.5.1.**

The explanatory power (R^2) for FSS model is 0.38 in the case of pooled OLS model. This reflects that 38% change in FSS model can be explained jointly by the given firm or MFIs specific factors, while the remaining 62% is attributed to the factors outside the model. In the case of fixed effect for FSS model explanatory power (R^2) is 0.58 which reflects that 58% changes can be explained by the firm-specific determinants, while 42% is attributed to the factors outside the model. Moreover, the value of (R^2) for FSS random effect model is 0.38 reflecting that 38 % change in FSS model is due to Firm-specific variable and remaining 62% is attributed to the factors outside the model.

5.4.1.1 Yield on gross loan portfolio (yogp): The coefficient of Yield on gross portfolio is positively related and highly significant at 1% level of significance in all the three model. The overall result revealed that Yield on gross loan portfolio is a significant variable influencing financial self-sufficiency of Andhra Microfinance institutions.

5.4.1.2 Capital cost to assets (ccta): The coefficient of the capital cost to assets is negatively associated and insignificant in all the three model. Thus, it can be concluded that capital cost to assets is not a significant variable influencing financial self-sufficiency of Andhra Microfinance institutions.

5.4.1.3 Gross loan portfolio to total Assets (glpta): The coefficient of Gross loan portfolio to total assets is negatively associated and insignificant in pooled OLS and random effect model. Contrary to this it is positively associated in fixed effect model

but insignificant. The overall result revealed that Gross loan portfolio to total assets is not a significant variable influencing financial self-sufficiency of Andhra Microfinance institutions.

5.4.1.4 Average loan balance per borrower (l_albpb): The coefficient of average loan balance per borrower is positively associated but insignificant in the entire three model. Thus overall result revealed that Average loan balance or size is not a significant variable influencing financial self-sufficiency of Andhra Microfinance institutions.

5.4.1.5 Portfolio at risk (30) days (p30): The coefficient of the portfolio at risk is negatively associated with financial self-sufficiency and significant in the entire three models. However, it is highly significant in random effect model and positively significant at 5% level in both pooled OLS model and fixed effect model. Thus, the study concludes that the portfolio at risk is a significant variable influencing financial self-sufficiency of Andhra microfinance institutions.

5.4.1.6 Labour cost to assets (pea): The coefficient of labour cost to assets is negative in all the three model. However, the coefficient is insignificant in the entire three models. Thus, the study concludes that labour cost to assets is not significant variable influencing financial self-sufficiency of Andhra microfinance institutions.

5.4.1.7 Size of mfis (assets) (l_ass): The coefficients of the size of mfis are positively associated with financial self-sufficiency in the entire three models and highly significant at 1% level of significance in pooled OLS and random effect model. While it is positively significant at 5% level in random effect model. This clearly indicates that size of microfinance institution is an important determinant that influences the financial self-sufficiency of Andhra's microfinance institution.

5.4.1.8 Age of mfis (age): The coefficient of age is negatively associated and highly significant at 1% level of significance in the entire three models. This clearly indicates that the age of mfis is an important indicator influencing financial self-sufficiency.

5.4.2 Results of Operational self-sufficiency model by pooled OLS model, fixed effect model and random effect regression models

This section shows the result of factors affecting Operational self-sufficiency model by pooled OLS model, random effect model and fixed effect model. To check consistency, all the three models of panel data are employed. Finally, result and

interpretation are based on most appropriate model which is chosen on the basis of the result of F test to make a choice between pooled OLS and fixed effect model, Breusch pagan test to make a choice between pooled OLS and random effect model. Finally, Hausman test to make a choice between random and fixed effect model.

Operational model for OSS

$$(OSS)_{i,t} = \alpha_i + \beta_1 (YOGP)_{i,t} + \beta_2 (CCTA)_{i,t} + \beta_3 (GLPTA)_{i,t} + \beta_4 (L\_ALBPB)_{i,t} + \beta_5 (P30)_{i,t} + \beta_6 (PEA)_{i,t} + \beta_7 (L\_ASS)_{i,t} + \beta_8 (AGE)_{i,t} + \varepsilon_{i,t}$$

5.4.2.0 Summary of panel data

This section summarised the coefficients of econometric regressions (pooled, fixed and random) to facilitate an overall overview. Table **5.3** shows panel data regression for the year 2005-2013 with Operational self-sufficiency as the dependent variable. The table reports summary of various regression models of Operational self-sufficiency (OSS) on (glpta), yield on gross loan portfolio (yogp), capital cost to assets (ccta), gross loan portfolio to total assets (glpta), average loan balance per borrower (albpb), portfolio at risk (30) days (p30), labour cost to assets (pea), size of MFI, Assets (ass), age of MFI in years (AGE).

Table **(5.3**) shows the results from pooled, fixed, and random models. The dependent variable is the Operational self-sufficiency. According to the result of panel diagnostic command fixed effect model is most appropriate and consistent than Pooled OLS and Random effect model. *, **, *** indicate significant at 10%, 5% and 1% level respectively. Figures that are in bold are p values. Figures in parenthesis are t values based on Robust (HAC) standard errors. Figures in brackets are coefficients.

Table 5.3 Model 2: Dependent variable: Operational self sufficiency (OSS)

Included 10 cross-sectional units

Time-series length: minimum 5, maximum 9

Robust (HAC) standard error

Variable	Pooled OLS regression model	Fixed effect regression model	Random effects regression
Const	(0.52569) [0.7771] **0.43984**	(01656.82) [1.3915] **0.16939**	(0.52569) [0.5663] **0.57306**
YOGP	(0.817794) [0.7771] **0.02786****	(0.830198) [2.4923] **0.01557****	(0.817794) [3.8401] **0.00028*****

CCTA	(-0.394196) [-0.5252] **0.60118**	(3.49965) [3.1845] **0.00233*** **	(-0.394196) [-0.5236] **0.60225**
GLPTA	(-0.0227947) [-0.3909] **0.69712**	(0.0188612) [0.3835] **0.70273**	(-0.0227947) [-0.5086] **0.61271**
L_ALBPB	(0.18985) [1.2841] **0.20352**	(0.45711) [2.7349] **0.00826*** **	(0.18985) [1.0165] **0.31303**
P30	(-0.902574) [-2.9123] **0.00487*** **	(-0.720113) [-1.9208] **0.05968***	(-0.902574) [-6.1324] **0.00001*** **
PEA	(-3.50252) [-1.0097] **0.31629**	(-6.03058) [-1.9139] **0.06057***	(-3.50252) [-1.1064] **0.27250**
L_ASS	(0.0362719) [1.4869] **0.00001*** **	(0.0987777) [1.9776] **0.00001*** **	(0.0362719) [1.3205] **0.00112*** **
AGE	(-0.291057) [-3.5120] **0.00080*** **	(-1.39381) [-4.5002] **0.00003*** **	(-0.291057) [-2.0884] **0.04057** **
R^2 **Adjusted R^2** **F-statistics** **P -value (F)** **Durban-Watson**	**0.545384** **0.491102** **10.04715** **4.42e-09** **1.532618**	**0.694933** **0.605517** **7.771897** **1.48e-09** **1.923846**	**0.379881** **0.305837** **5.130470** **0.000053** **1.612173**

Source: Gretl. Output

The present study employed pooled OLS model, fixed effect model and Random effect model of panel data to check the consistency of results. Though, results and interpretation are based on a most appropriate model which is determined on the basis of result of F test, Breusch-pagan test and Hausman test. The result in Appendix (H), Table 2 of panel diagnostic command for OSS model shows that the F-statistic value is 3.15 with P value (0.003). It clearly shows that the corresponding P value of F-statistic is lower than the 0.05 (5 % level of significance). Thus, the null hypothesis

(pooled OLS model) is more appropriate and consistent than the fixed effects model and stands rejected. Secondly, Breusch-Pagan test is applied on OSS model to decide between pooled regression and random effects model. The LM statistic value is 0.003 with P value 0.955, as the P-value is much greater than the 5 % level of significance. Therefore, Null hypothesis articulated as pooled regression is more consistent and appropriate than the random effects model remains accepted. Finally, the choice between fixed effects and random effects tested through Hausman's specification test. The null hypothesis is framed as the random effect is more appropriate and consistent with fixed effects model. The result of Hausman test in Appendix (H), Table 2 for OSS model indicates that the p-value of is much less than the 5% level of significance. A low p-value count against the random effects model is consistent, in favour of the fixed effect model. Hence, fixed effect is more consistent than the random effects model. Thus based on the panel diagnostic test in case of Oss model. The results indicate that fixed effect model is more appropriate than pooled OLS and Random effect model. Therefore interpretation and results of for Operational self-sufficiency (OSS) model are based on the fixed effects model which is discussed in detail in section **5.5.2.**

The explanatory power (R^2) for OSS model is 0.54 in the case of pooled OLS model. This reflects that 54% change in OSS model can be explained jointly by the given firm or MFIs specific factors; while the remaining 46% is attributed to the factors outside the model. In the case of fixed effect for OSS model explanatory power (R^2) is 0.69 which reflects that 69% changes can be explained by the firm-specific determinants, while 31% is attributed to the factors outside the model. Moreover, the value of (R^2) for OSS random effect model is 0.379 reflecting that 38 % change in OSS model is due to Firm-specific variable and remaining 62% is attributed to the factors outside the model.

5.4.2.1 Yield on gross portfolio (yogp): The coefficient of yield on positively associated in all the three model and highly significant only in the random effects model at 1% level. While it is positively significant at 5% level in fixed effect and pooled OLS model. The overall result revealed that Yield on gross loan portfolio is a significant variable influencing financial self-sufficiency of Andhra Microfinance institutions.

5.4.2.2 Capital cost to assets (ccta): The coefficient of the capital cost to assets is positive and highly significant at 1% level in fixed effect model. However, the coefficient of the capital cost to assets is negatively insignificant in pooled OLS and random effect model.

5.4.2.3 Gross loan portfolio to total assets (glpta): The coefficient of the gross loan portfolio to total assets is positively insignificant in fixed effect model. While in pooled OLS model and random effect model it is negatively insignificant. The overall result revealed that Gross loan portfolio to total assets is not a significant variable influencing financial self-sufficiency of Andhra Microfinance institutions.

5.4.2.4 Average loan balance per borrower l_(albpb): The coefficient of average loan balance per borrower is positively and highly significant in the fixed effect regression model. However, it is positively associated but insignificant in both pooled OLS model and random effect model.

5.4.2.5 Portfolio at risk (30) days (P30): The coefficient of the portfolio at risk is positively associated with operational self-sufficiency in the entire three model. However, it is only highly significant at 1% level in pooled OLS model and random effect model. It is also positively significant at 10 % level in random effect model.

5.4.2.6 Labour cost to assets (pea): The coefficient of labour cost to assets is negatively related and insignificant in the entire model except fixed effect model. Thus, it can be concluded that labour cost to assets is not significant variable influencing financial self-sufficiency of Andhra microfinance institutions.

5.4.2.7 Size of MFIs (ass): The coefficient of the size of MFIs is positive and highly significant at 1% level in the entire three models. This clearly indicates that size of microfinance institution is an important determinant that influences the financial self-sufficiency of Andhra microfinance institutions.

5.4.2.8 Age of MFIs (AGE): The coefficient of the age of MFIs is highly significant at 1% level and positively associated in both pooled OLS model and fixed effect model. It is also positively significant at 5% level in random effect model.

5.4.3 Results of Portfolio at Risk model by Pooled OLS model, Fixed effect model and Random effect regression models

This section shows the result of factors affecting Portfolio at risk (P30) model by pooled OLS model, random effect model and fixed effect model. To check consistency, all the three models of panel data are employed. Finally, results and interpretations are based on a most appropriate model which is chosen on the basis of the result of F test to make a choice between pooled OLS and fixed effect model, Breusch pagan test to make a choice between pooled OLS and random effect model. Finally, Hausman test to make a choice between random and fixed effect model.

Operational model for P30

$$(P30)_{i,t} = \alpha_i + \beta_1 (YOGP)_{i,t} + \beta_2 (ALBPBG)_{i,t} + \beta_3 (GLPTA)_{i,t} + \beta_4 (PEA)_{i,t} + \beta_5 (POFB)_{i,t} + \beta_6 (AGE)_{i,t} + \beta_7 (L\_ASS)_{i,t} + \varepsilon_{i,t}$$

5.4.3.0 Summary of panel data

This section summarised the coefficients of econometric regressions (pooled, fixed and random) to facilitate an overall overview. The table **5.4** shows panel data regression for the year 2005-2013 with regression results of portfolio at risk (P30) on yield on gross loan portfolio (yogp), average loan balance per borrower adjusted by GNI per capita (albpbg) Gross loan portfolio to total assets ratio (glpta), labour cost to assets (pea), Percentage of female borrower (pofb), age of mfis in years (AGE), size of mfi-log Assets (l_ass).

Table **(5.4)** shows the results from pooled, fixed, and random models. The dependent variable is Portfolio at risk. According to the result of panel diagnostic command pooled OLS model is most appropriate and consistent than fixed effect and Random effect model. *, **, *** indicate significant at 10%, 5% and 1% level respectively. Figures that are in bold are p values. Figures in parenthesis are t values based on Robust (HAC) standard errors. Figures in brackets are coefficients.

Table 5.4 Model 3: Dependent variable: Portfolio at Risk (P30)

Included 10 cross-sectional units

Time-series length: minimum 5, maximum 9

Robust (HAC) standard errors

Variable	Pooled OLS regression model	Fixed effect regression model	Random effects regression
Const	(0.385589) [2.9654] **0.00417*****	(0.385589) [0.8108] **0.42076**	(0.803666) [2.8880] **0.00519*****
YOGP	(0.578711) [4.0503] **0.00013*****	(0.578711) [3.1518] **0.00255*****	(0.685151) [5.4276] **0.00001*****
ALBPBG	(-3.75632) [-5.3822] **0.00001*****	(-3.75632) [-5.0482] **0.00001*****	(-4.12839) [-5.4553] **0.00001*****
GLPTA	(0.0102105) [1.4859] **0.00001*****	(0.0102105) [0.4426] **0.65964**	(0.0552382) [1.9361] 0.05702*
PEA	(-9.28711) [-4.2896] **0.00006*****	(-9.28711) [-9.2954] <0.00001***	(-9.39354) [-5.2981] **0.00001*****
POFB	(-6.86591) [-3.1390] **0.00251*****	(-6.86591) [-5.9781] **0.00001*****	(-2.94498) [-2.9036] **0.00497*****
AGE	(0.349701) [1.1593] **0.25039**	(0.349701) [1.5622] **0.12358**	(0.0784175) [0.8453] **0.40089**
L_ASS	(-0.018961) [0.0664] **0.94722**	(-0.018961) [-0.9308] **0.35573**	(0.000819632) [0.0472] **0.96248**
R- squared	**0.643135**	**0.766323**	**0.643135**
Adjusted R^2	**0.606399**	**0.702953**	**0.606399**
F-statistics	**17.50690**	**12.09285**	**17.50690**
P-value (F)	**4.84e-13**	**3.66e-13**	**0.000000**
Durbin Watson	**1.319928**	**1.944875**	**1.520716**

Source: Gretl. Output

The study employed pooled OLS model, fixed effect model and Random effect model of panel data to check the consistency of results. Though, results and interpretation

are based on most appropriate model which is determined on the basis of result of F test, Breusch-pagan test and Hausman test. The result in Appendix (H), Table 3 of panel diagnostic command for Portfolio at risk (P30) model shows that the F-statistic value is 1.499 with P value (0.168). It clearly shows that the corresponding P value of F-statistic is greater than the 0.05 (5%) level of significance. Thus, the null hypothesis articulated as (pooled OLS model) is more appropriate and consistent than the fixed effects model stands accepted. Secondly, Breusch-Pagan test is applied on P30 model to decide between pooled regression and random effects model. The LM statistic value is 0.082 with P value 0.773. As the P-value is much greater than the 5 % level of significance. Therefore, Null hypothesis articulated as pooled regression is more consistent and appropriate than the random effects model remains accepted. Finally, the choice between fixed effects and random effects tested through Hausman's specification test. The null hypothesis is framed as the random effect is more appropriate and consistent with fixed effects model. The result of Hausman test in Appendix (H), Table 3 for P30 model indicates that the low p-value of 0.01 is much less than the 5% level of significance. A low p-value count against the random effects model is consistent, in favour of the fixed effect model. Hence, fixed effect is more consistent than the random effects model. Thus based on the panel diagnostic test in case of the portfolio at risk model revealed that pooled OLS is more consistent and appropriate than the Fixed effect and Random effect models. Therefore, results and interpretation for Portfolio at risk (P30) model are based on the Pooled OLS model which is discussed in detail in section **5.5.3.**

The explanatory power (R^2) for P30 model is 0.643 in the case of pooled OLS model. This reflects that 64% change in P30 model can be explained jointly by the given firm or MFIs specific factors; while the remaining 36% is attributed to the factors outside the model. In the case of fixed effect for P30 model explanatory power (R^2) is 0.766 which reflects that 77% changes can be explained by the firm-specific determinants, while 23% is attributed to the factors outside the model. Moreover, the value of (R^2) for P30 random effect model is 0.643 reflecting that 64 % change in P30 model is due to Firm-specific variable and remaining 36% is attributed to the factors outside the model.

5.4.3.1 Yield on gross loan portfolio (yogp): The coefficient of yield on gross portfolio is positively related and highly significant at 1% level of significance in all the three model. The overall result revealed that Yield on gross loan portfolio is a significant variable influencing loan repayment performance of Andhra Microfinance institutions.

5.4.3.2 Average loan balance per borrower adjusted by GNI per capita (albpbg): The coefficient of average loan balance per borrower is negatively related and highly significant across all the model. Therefore average loan balance per borrower is a significant determinant of the portfolio at risk.

5.4.3.3 Gross loan portfolio to total assets ratio (glpta): The disaggregated results are found across all the models. In Pooled OLS model the coefficient is highly positive and significant. Although, in fixed effect model the relationship is significant. In random effect model relationship is positively significant at 10% level of significance.

5.4.3.4 Labour cost to assets ratio (pea): The relationship between labour costs to assets ratio is strongly significant and negatively related to portfolio at risk across all the models. Therefore, labour cost to assets is a significant determinant of the portfolio at risk.

5.4.3.5 Percentage of female borrowers (pofb): The coefficient of women clients is highly significant and negatively associated with portfolio at risk in all the three model. Therefore women borrowers are a significant determinant of the percentage of the portfolio at risk.

5.4.3.6 Age of MFIs (age): Age of MFIs is not variable influencing loan repayment performance. As the relationship is positively associated but insignificant across all the models.

5.4.3.7 Size: The coefficient of size is positively associated in pooled OLS model and fixed effect model. While, it is negatively associated in random effects model. However, the relationship is insignificant across all the models. Therefore, it can be concluded that age of MFIs is not a significant factor influencing financial self-sufficiency.

5.4.4 Results of POFB model by Pooled OLS model, fixed effect model and Random effect regression models.

The result of percentage of female client's model is shown by pooled OLS model, random effect model and fixed effect model. To check consistency, all the three models of panel data are employed. Finally, results and interpretation are based on most appropriate model which is chosen on the basis of the result of F test to make a choice between pooled OLS and fixed effect model and Breusch pagan test to make a choice between pooled OLS and random effect model. Finally, Hausman test to make a choice between random and fixed effect model.

Operational model for POFB

$$(POFB)_{i,t} = \alpha_i + \beta_1 (FSS)_{i,t} + \beta_2 (OSS)_{i,t} + \beta_3 (AGE)_{i,t} + \beta_4 (L\_ASS)_{i,t} + \beta_5 (P30)_{i,t} + \beta_6 (CCTA)_{i,t} + \beta_7 (GLPTA)_{i,t} + \varepsilon_{i,t}$$

5.4.4.0 Summary of panel data

This section summarised the coefficients of econometric regressions (pooled, fixed and random) to facilitate an overall overview. Table **5.5** shows panel data regression for the year 2005-2013 with the percentage of female clients as the dependent variable. Table reports summary of various outreach model of Percentage of female clients (POFB) on Financial self-sufficiency (FSS), operational self-sufficiency (OSS), age of MFIs in years (age) Size (l_ass) portfolio at risk (30) days (P30), capital cost to total assets ratio (ccta), Gross loan portfolio to total assets ratio (glpta)

Table **(5.5)** shows the results from pooled, fixed, and random models. The dependent variable is the Percentage of female borrowers. According to the result of panel diagnostic command pooled OLS model is most appropriate and consistent than Random effect and fixed effect model. *,**,*** indicate significant at 10%, 5% and 1% level respectively. Figures that are in bold are p values. Figures in parenthesis are t values based on Robust (HAC) standard errors. Figures in brackets are coefficients.

Table 5.5 **Model 4: Dependent variable: (POFB)**

Included 10 cross-sectional units

Time-series length: minimum 5, maximum 9

Robust (HAC) standard errors

Variable	**Pooled OLS regression model**	**Fixed effect regression model**	**Random effects regression**
Const	(1.05308) [17.7708] **0.00001*** **	(1.03614) [23.7840] **0.00001*** **	(1.05308) [34.0929] **0.00001**
FSS	(0.00676775) [1.6270] **0.10837**	(-0.0047359) [-0.5363] **0.59379**	(0.00676775) [0.5975] **0.55219**
OSS	(-0.00637251) [-1.0161] **0.31320**	(0.016055) [1.6801] **0.09823***	(-0.00637251) [-0.6561] **0.51399**
AGE	(-0.0111015) [-0.9046] **0.36886**	(0.0367514) [2.0579] **0.04403****	(-0.0111015) [-1.0421] **0.30105**
L_ASS	(-0.00141999) [-0.4595] **0.64733**	(-0.00845715) [-1.9139] **0.06049***	(-0.00141999) [-0.7129] **0.47835**
P30	(-0.0189958) [-1.1336] **0.26094**	(-0.0148549) [-1.8241] **0.07320***	(-0.0189958) [1.7159] **0.09073***
CCTA	(0.0126612) [0.3669] **0.71483**	(-0.0502105) [-0.8492] **0.39919**	(0.0126612) [0.2481] **0.80477**
GLPTA	(-0.0037971) [-1.9191] 0.05917*	(-0.00445425) [-2.9647] 0.00437***	(-0.0037971) [-1.1753] 0.24399
R-squared	**0.218142**	**0.742245**	**0.218142**
Adjusted R^2	**0.137657**	**0.672346**	**0.137657**
F-statistics	**2.710337**	**10.61874**	**2.710337**
P-value (F)	**0.015390**	**5.34e-12**	**0.015390**
Durbin Watson Test	**0.3888353**	**1.075426**	**0.542921**

Source: Gretl. Output

This study employed pooled OLS model, fixed effect model and Random effect model of panel data to check the consistency of results. Though, results and interpretation are based on most appropriate model which is determined on the basis of result of F test, Breusch-pagan test and Hausman test. The result in Appendix (H), Table 4 of panel diagnostic command for Outreach (pofb) model shows that the F-statistic value is 13.32 and p-value less than the desired level. It clearly shows that the corresponding P value of F-statistic is lower than the 0.05 (5% level of significance) thus the null hypothesis (pooled OLS model) is more appropriate and consistent than the fixed effects model stands rejected. Secondly, Breusch-Pagan test is applied on (pofb) model to decide between pooled regression and random effects model. The LM statistic value is 91.5 with P-value less than 0.05. As the P-value is much lower than the 5 % level of significance. Therefore, Null hypothesis articulated as pooled regression is more consistent and appropriate than the random effects model remains rejected. Finally, the choice between fixed effects and random effects tested through Hausman's specification test. The null hypothesis is framed as the random effect is more appropriate and consistent with fixed effects model. The result of Hausman test in Appendix (H), Table 4 for model indicates that the low p-value is much less than the desired i.e. 5% level of significance. A low p-value counts against the random effects model is consistent, in favour of the fixed effect model. Hence, fixed effect is more consistent than the random effects model. Thus based on the panel diagnostic test in case of outreach (POFB) model fixed effect model is more consistent and appropriate than Pooled and Random effects models. Therefore results and interpretation of (POFB) model are based on the fixed effects model which is discussed in detail in section **5.5.4**.

The explanatory power (R^2) for POFB model is 0.218 in the case of pooled OLS model. This reflects that 21% change in POFB model can be explained jointly by the given firm or MFIs specific factors; while the remaining 79% is attributed to the factors outside the model. In the case of fixed effect for POFB model explanatory power (R^2) is 0.742 which reflects that 74% changes can be explained by the firm-specific determinants, while 26% is attributed to the factors outside the model. Moreover, the value of (R^2) for POFB random effect model is 0.218 reflecting that 22

% change in POFB model is due to Firm-specific variable and remaining 78% is attributed to the factors outside the model.

5.4.4.1 Financial self-sufficiency (FSS): Financial self-sufficiency is an insignificant determinant of outreach to female clients as shown across all the three models. It proves that financial self-sufficiency is not significant determinant of outreach to female clients.

5.4.4.2 Operational self-sufficiency (OSS): Operational self-sufficiency is negatively associated with outreach in all the models. However, the relationship is significant at 10% level only in fixed effect model.

5.4.4.3 Age of MFIs (AGE): The coefficient of age is negatively insignificant in pooled OLS and random effects model. However, the relationship is significant at 5% level and positively related to outreach to female clients in fixed effect model.

5.4.4.4 Size of MFIs (Size): The size of MFIs is negatively and insignificantly associated with outreach to female clients across all the models. Though the relationship is significant at 10% level in only fixed effects model.

5.4.4.5 Portfolio at risk (30) days (p30): The coefficient of the portfolio at risk is negatively significant at 10% level in fixed and random effect model. The relationship is similar in pooled OLS model but insignificant.

5.4.4.6 Capital cost to total assets ratio (Ccta): The coefficient of the capital cost to assets ratio is insignificant across the entire models. Therefore capital cost to assets ratio is not a significant determinant of outreach to female client's model.

5.4.4.7 Gross loan portfolio to total assets ratio (Glpta): The summary of panel models shows that coefficients of the gross loan portfolio to total assets ratio is negatively related in all the models. However, the relationship is significant in pooled OLS model at 10% level and strongly significant in fixed effect model and insignificant in random effects model.

5.4.5 Results of outreach (albpbg) model a by Pooled OLS model, fixed effect model and Random effect regression models

This section shows the result of average loan balance per borrower outreach model by pooled OLS model, random effect model and fixed effect model. To check consistency, all the three models of panel data are employed. Finally, result and interpretations are based on most appropriate model which is chosen on the basis of

the result of F test to make a choice between pooled OLS and fixed effect model, Breusch pagan test to make a choice between pooled OLS and random effect model. Finally, Hausman test to make a choice between random and fixed effect model.

Operational model for ALBPBG

$$(ALBPBG)_{i,t} = \alpha_i + \beta_1 (FSS)_{i,t} + \beta_2 (OSS)_{i,t} + \beta_3 (AGE)_{i,t} + \beta_4 (L\_ASS)_{i,t} + \beta_5 (P30)_{i,t} + \beta_6 (CCTA)_{i,t} + \beta_7 (GLPTA)_{i,t} + \varepsilon_{i,t}$$

5.4.5.0 Summary of panel data

The coefficients of econometric regressions (pooled, fixed and random) have been summarised to facilitate an overall overview. Table **5.6** shows panel data regression for the year 2005-2013 with average loan balance per borrower adjusted by GNI per capita as the dependent variable. The table reports summary of various regression model of outreach model measured by average loan balance adjusted by GNI per capita (albpbg) on Financial self-sufficiency (FSS), operational self-sufficiency (OSS), age of MFIs in years (age), Size (l_ass), portfolio at risk (30) days (P30), capital cost to total assets ratio (ccta), Gross loan portfolio to total assets ratio (glpta).

Table **(5.6)** shows the results from pooled, fixed, and random models. The dependent variable is average loan balance adjusted by GNI per capita. According to the result of panel diagnostic command, Random effect model is most appropriate and consistent than Pooled OLs and Random effect model. *,**,*** indicate significant at 10%, 5% and 1% level respectively. Figures that are in bold are p values. Figures in parenthesis are t values based on Robust (HAC) standard errors. Figures in brackets are coefficients.

Table 5.6 **Model 5: Dependent variable: (ALBPBG)**

Included 10 cross-sectional units

Time-series length: minimum 5, maximum 9

Robust (HAC) standard errors

Variable	Pooled OLS regression model	Fixed effect regression model	Random effects regression
Const	(0.17342) [2.7861] **0.00691*****	(0.114801) [1.2303] **0.22347**	(90.161591) [2.6154] **0.01097**
FSS	(0.0210701) [2.3538] **0.02148****	-0.00382915) [-0.1784] **0.85900**	(0.00294024) [0.1907] **0.84933**
OSS	(0.0210618)	(0.0355574)	(0.0318915)

	[1.4515] **0.15124**	[2.2427] **0.02869****	[2.7187] **0.00831*****
AGE	(-0.000759334) [-0.0381] **0.96971**	(-0.0325554) [-1.2184] **0.22793**	(-0.0312812) [-1.2798] **0.20497**
L_ASS	(-0.00322176) [-0.6777] **0.50024**	(0.00575698) [-1.2431] **0.32272**	(0.00287627) [0.6701] **0.50509**
P30	(-0.0262304) [-1.3753] **0.17356**	(-0.0155125) [-1.2431] **0.21876**	(-0.0149341) [-1.1044] **0.27331**
CCTA	(-0.115482) [-1.3112] **0.19419**	(-0.347582) [-3.0273] **0.00365*****	(-0.296781) [-3.7193] **0.00041*****
GLPTA	(-0.00181039) [-0.6523] **0.51638**	(0.00174886) [0.7513] **0.45546**	(0.000896156) [0.2470] **0.80564**
R-squared	**0.332121**	**0.676327**	**0.496804**
Adjusted R^2	**0.263369**	**0.626234**	**0.445004**
F-statistic	**4.830688**	**7.705187**	**9.5540873**
P-value (F)	**0.000185**	**2.38e-09**	**0.000000**
Durbin Watson	**0.941964**	**1.787962**	**2.024957**

The study employed pooled OLS model, fixed effect model and Random effect model of panel data to check the consistency of result. However, results and interpretation are based on most appropriate model which is determined on the basis of result of F test, Breusch-pagan test and Hausman test. The result in Appendix (H), Table 5 of panel diagnostic command (a command in Gretl. software for generating results of F test, Breusch pagan test and Hausman test) for Outreach (albpbg) model shows that the F-statistic value is 6.97 and p-value less than the desired level. It clearly shows that the corresponding P value of F-statistic is less than the 0.05 (5% level of significance). Thus, the null hypothesis (pooled OLS model) is more appropriate and consistent than the fixed effects model and stands rejected. Secondly, Breusch-Pagan test is applied on the (albpb) model in order to decide between pooled regression and random effects model. The LM statistic value is 13.61 with P value 0.0002. As the P-value is much lower than the 5 % level of significance. Therefore, Null hypothesis

articulated as pooled regression is more consistent and appropriate than the random effects model remains rejected. Finally, the choice between fixed effects and random effects tested through Hausman's specification test. The null hypothesis is framed as the random effect is more appropriate and consistent with fixed effects model. The result of Hausman test in Appendix (H), Table 5 for model indicates that the p-value is 0.54 which is much higher than the desired i.e. 5% level of significance. Hence, random effect is more consistent than the fixed effects model. Thus based on the panel diagnostic test in case of outreach (albpb) model Random effect model is more consistent and appropriate than Pooled and Fixed effects models. Therefore interpretation and results of the (albpbg) model are based on the random effects model which is discussed in detail in section **5.5.5.**

The explanatory power (R^2) for the model is (0.332) in the case of pooled OLS model. This reflects that 33 % change in (albpbg) model can be explained jointly by the given firm or MFIs specific factors; while the remaining 67% is attributed to the factors outside the model. In the case of fixed effect for (albpbg) model explanatory power (R^2) is 0.676 which reflects that 68% changes can be explained by the firm-specific determinants, while 32% is attributed to the factors outside the model. Moreover, the value of (R^2) for (albpbg) random effect model is 0.496 reflecting that 50 % change in (albpbg) model is due to Firm-specific variable and remaining 50% is attributed to the factors outside the model.

5.4.5.1 Financial self-sufficiency (FSS): The summary of panel models shows that the coefficient of FSS is positive in both pooled OLS and random effect model. However, the relationship is significant in only pooled OLS model at 5% level of significance. In fixed effect model, the relationship is negatively insignificant.

5.4.5.2 Operational self-sufficiency (OSS): The coefficients of operational self-sufficiency positively associated with outreach in all the models. However, the relationship is only significant in only fixed effect model at 5% level and 10% level in random effect model. In pooled OLS model relationship is insignificant.

5.4.5.3 Age of MFIs (AGE): The summary of panel models of the depth of outreach show that the coefficient of age is negatively insignificant across the models. Therefore, it can be concluded that age is not a significant factor influencing outreach.

5.4.5.4 Size of MFIs (Size): The summary of panel data shows that the coefficient of size is insignificant across all the models. Therefore, Size is not a significant determinant of the depth of outreach.

5.4.5.5 Portfolio at risk (30) days: The coefficient of the portfolio at risk is negatively insignificant across all the models. Therefore, portfolio at risk is an insignificant factor influencing depth of outreach.

5.4.5.6 Capital cost to total assets ratio (Ccta): The regression findings of panel models show that capital cost to total assets ratio negatively associated across the models. However, the relationship is strongly significant at 1% level in only fixed effect and random effect model and insignificant in pooled OLS model.

5.4.5.7 Gross loan portfolio to total assets ratio (Glpta): The coefficient of the gross loan portfolio to total assets ratio is insignificant across all the models. Therefore, it is not a significant determinant of the depth of outreach.

5.5 FINDINGS AND DISCUSSION

This section discusses the findings and discussion of financial self-sustainability, operational self-sustainability, portfolio at risk, outreach to poor measured by average loan balance per borrower and outreach to female clients measured by the percentage of female clients in the loan portfolio.

5.5.1 Findings and Discussion of Financial self-sustainability (FSS) model

5.5.1.1Yield on gross loan portfolio: The yield on gross loan portfolio measure of the average interest rate on loan to customers is strongly significant and positively associated at 1% significance level in Pooled model. It indicates that increasing interest rates improve the financial sustainability of Andhra Microfinance institutions. The econometric result of regression analysis revealed that for one unit increase in a yield on gross loan portfolio financial self-sustainability ratio is expected to increase by 0.66 units, holdings all other variables constant. This suggests that yield on gross loan portfolio is significant variable influencing the financial sustainability of microfinance institutions. It also indicates that MFIs tend to be more profitable when interest rates are higher. Finally, it can be concluded that increasing interest rates are clearly associated with improved level of financial self-sufficiency. The findings of this study are consistent with that of Nyamsogoro (2010), Crombrugghe *et. al*. (2008)

concluded that yield on gross loan portfolio positively affects the financial sustainability of microfinance institutions. The findings of the Cull *et. al.* (2007) revealed that yield on gross loan portfolio is significant and positively associated across all the measures of financial self-sustainability i.e. Return on Assets, Financial Sustainability, Operational self-sustainability for individual based lenders only. Therefore, based on the pooled regression model result from the study. The alternative hypothesis articulated as the yield on gross loan portfolio is positively associated with financial self-sufficiency remains accepted.

5.5.1.2 Capital cost to Assets: The study finds an insignificant negative relationship of capital cost to assets with financial self-sufficiency. Therefore by the result, it can be concluded that capital cost to assets is insignificant variable influencing financial self-sufficiency of Andhra Microfinance institutions. The result of Cull *et. al.* (2007) indicated that coefficients on the capital cost variables show differences in the way of the different type of lenders (Individual, Group and solidarity) generate profits. The findings revealed insignificant difference between capital cost and financial sustainability measure for group lenders. Therefore based on the regression results, the alternative hypothesis articulated as there is a negative relationship between capital cost to assets and financial self-sufficiency is rejected.

5.5.1.3 Gross loan portfolio to total assets: Gross loan portfolio is an insignificant predictor in determining financial self-sufficiency. This finding reveal that Gross loan portfolio to total assets ratio is insignificant variable influencing financial self-sufficiency of Andhra Microfinance institutions. However, the findings of Cull *et. al.* (2007) revealed loan to assets ratio is significant and positively associated with measures of financial sustainability. Therefore based on the regression result from the study the alternative hypothesis formulated as there is positive relationship between gross loan portfolio to total assets and financial self-sufficiency is rejected.

5.5.1.4 Log of average loan balance per borrower: The average loan size defined as the average gross loan divided by the number of borrowers. The coefficient is positively associated but insignificant in pooled OLS regression model. The result of regression analysis shows that average loan size is not a significant predictor of financial sufficiency. This finding is consistent with the findings of Cull *et. al*. (2006) which indicates that average loan size is not strongly significant with financial

sustainability of Microfinance institutions. The study of Nadiya, Olivares-Polanco & Ramanan (2012) found that operational self-sufficiency is significantly and negatively associated with average loan size per borrower is against the study findings. This findings is also against the findings Gregoire and Tuya (2006), Adongo and Stork (2005), Gonzalez (2007), Nyamsogoro (2010) which revealed that financial sustainability is significantly and positively linked to average loan size. Therefore, based on the regression result from the study, the alternative hypothesis articulated as there is positive relationship between average balance per borrower and financial self-sufficiency remains rejected.

5.5.1.5 Portfolio at risk (30) days: The portfolio at risk measures indicates how much a Microfinance institution is efficient in making collections of loans. The higher the portfolio at risk shows lower repayment rates, an indication of inefficient MFIs. In simple words, a high portfolio at risk ratio would limit the income derived from Microfinance operations and therefore amount of lendable funds reduces. This would result in rationing of credit and ultimately the continuous supply of quality loan services would be affected and have a negative impact on financial sustainability of MFIs. The result of regression analysis revealed that the coefficient is significant at five% level and negatively associated with financial self-sufficiency. It indicates that Less efficient the MFIs with higher portfolio at risk. Ultimately, less will be its financial sustainability. The result of regression analysis confirms the alternative hypothesis namely that significant reduction in portfolio at risk (30) days should have a positive impact on the financial sustainability of MFIs i.e. portfolio at risk is expected to be negatively associated with financial sufficiency. This finding is consistent with prior empirical findings of Nyamsogoro (2010) and Ayayi and Sene (2010) found negative relationship of portfolio at risk with financial sustainability.

5.5.1.6 Labour cost to assets (pea): Labour cost to assets is insignificant negative predictor in determining financial self-sufficiency of Andhra Microfinance institutions. Therefore, it can be concluded that labour cost to assets is insignificant variable influencing financial self-sufficiency. This finding is contrary to findings of Cull *et. al.* (2007) found that labour cost are associated with improved profitability for individual based lenders. For group based lenders the coefficient on their labour cost variable is negative and significant. The findings of this study show that coefficient is

negatively associated but insignificant in pooled OLS model i.e. most appropriate model as per the result of panel diagnostic. Therefore based on the regression result from the study, the null hypothesis formulated as there is no significant relationship between labour cost to assets ratio and financial sustainability is rejected.

5.5.1.7 Size (Total Assets): Total Assets is the proxy measure for the size of MFIs. The econometric result of regression analysis revealed that Total Assets is strongly significant at 1% level and positively associated with financial self-sufficiency. It indicates that MFI size does improve its financial sustainability. It means that a change in the size (total Assets) causes a change in financial sustainability positively. The econometric result revealed that for one unit increase in Size of MFIs, financial self-sufficiency ratio is expected to increase by (0.03) units, holdings all other variable constant. The findings of this study are consistent with that of Cull *et. al*. (2006) & (2007) found that MFIs size is positively and significantly linked to financial self-sufficiency. This finding is also consistent with Bogan *et. al.* (2007), Hartarska and Nadolnyak (2007), Coleman and Osie (2008) and Robinson (2001). However or findings is contrary to the results of Hartarska (2005). Thus, the finding do support the alternative hypothesis articulated as size of MFIs affects financial sustainability positively.

5.5.1.8 AGE (log value): The age of MFI refers to the period, MFIs has been operational since it came into existence. The variable age is expected to be positively related to financial self-sufficiency. However, the findings of pooled OLS regression model shows that age of MFIs is highly significant at 1% level and negatively associated with financial self-sufficiency. It indicates that MFIs age does not improve its financial sustainability. It also means that mature MFIs are not financially sustainable. This result is quite strange because with increasing age MFIs must become efficient. This finding contradict with the study of Cull *et .al.* (2007) which shows that MFIs age is significantly and positively related with financial self-sufficiency. This finding also contradicts with findings of Nadiya *et. al.* (2012) and Nyamsogoro (2010) which shows that age is not significant factor influencing financial self-sufficiency. Based on the result of regression analysis, the alternative hypothesis articulated as age of MFIs expected to be positively associated with financial self-sufficiency remains rejected.

5.5.2 Findings and Discussion of Operational self-sufficiency model.

5.5.2.1 Yield on gross loan portfolio: The coefficient for real gross portfolio yield (the measure of average interest loan to customers) is significant at 5% level and positively associated with operational sufficiency in most appropriate model i.e. pooled OLS model as per result of panel diagnostic. It indicates that Andhra Microfinance institutions tend to be more operationally self-sufficient when their interest rates are higher. It means that increasing interest rates are clearly associated improved level of operational self-sufficiency. Moreover, the econometric findings indicates that yield on gross loan portfolio is an important variable influencing operational self-sufficiency. The econometric result revealed that for one unit increase in yield on gross loan portfolio i.e. interest rates, operational self-sufficiency ratio is expected to increase by (0.81) units, holdings all other variable constant. This finding is consistent with the results of Kar (2010) which showed that increasing interest rates are associated with improved level of financial performance. This finding is in the line with Crombrugghe *et. al*. (2008); Cull *et. al.* (2007) and Nyamsogoro (2010). Therefore on the basis of finding the alternative hypothesis articulated as yield on gross loan portfolio is expected to be positively associated with financial self-sufficiency remains accepted.

5.5.2.2 Capital cost to assets: The econometric findings of pooled OLS regression model shows that the coefficient of capital cost to total assets ratio is negatively related but insignificant. It indicates that capital cost to assets is insignificant predictor of operational self-sufficiency. This finding is contrary to the findings of Cull *et. al*. (2007) which found that capital cost to assets is strongly significant and negatively associated with financial self-sufficiency. Therefore, the alternative hypothesis articulated as capital cost to total assets ratio is expected to be negatively associated with operational self-sufficiency is rejected.

5.5.2.3 Gross loan portfolio to total assets ratio: The coefficient of gross loan portfolio to total assets ratio is negatively insignificant in most appropriate i.e. pooled OLS model. The econometric findings of regression revealed that Gross loan portfolio to total assets ratio is insignificant determinant of operational self-sufficiency. The empirical findings contradict with the findings of Cull *et. al.* (2007) found that Gross loan portfolio is positively associated but insignificant with operational sufficiency.

Therefore, on the basis of result the null hypothesis articulated as there is no significant impact of gross loan portfolio to total assets ratio on operational self-sufficiency is accepted.

5.5.2.4 Average loan balance per borrower (log value): It is the ratio of outstanding loan portfolio over number of active borrower. The finding of Average loan balance per borrower is positively related with operational self-sufficiency but insignificant. However, despite of its insignificance, it is against the findings of Cull *et. al.* (2007), Nyamsogoro (2010), Nadiya *et. al*. (2012), Woller and Schreiner (2002) and Kar (2010). In general, the findings do not validate the null hypothesis articulated as there is no significant impact of average loan size on operational sufficiency.

5.5.2.5 Portfolio at risk (30) days: According to CGAP (2003) the portfolio at risk is the most commonly acceptable measure of portfolio quality. The quality of a loan portfolio indicates the loan principal and interest repayment performance. The higher the portfolio at risk ratio indicates the poor collection policy or MFIs is efficient in making loans collection therefore less financially sustainable. The econometric result of pooled regression model indicates strongly significant and negative relationship between portfolio at risk and operational sustainability. This suggest that higher portfolio at risk negatively affects the operational self-sufficiency of MFIs. The econometric result revealed that for one unit increase in portfolio at risk ratio, operational self-sufficiency ratio is expected to decrease by (0.90) units, holdings all other variable constant. The findings of this study conclude that Andhra microfinance institutions operational self-sufficiency is reducing with increasing loan delinquencies. The findings of this study is consistent with the findings of Kar (2010) found that Portfolio at risk is negatively associated with operational self-sufficiency. Thus the findings do support the null hypothesis framed as Portfolio at risk is expected to be negatively associated with operational self-sufficiency.

5.5.2.6 Labour cost to total Assets ratio: The coefficient of labour cost to total assets ratio is negatively insignificant in most appropriate i.e. pooled OLS model. The econometric findings of regression revealed that labour cost to total assets ratio is insignificant determinant of operational self-sufficiency. This empirical finding is consistent with the findings of Cull *et. al.* (2007) for only individual based lenders

5.5.2.7 Size of MFIs (log Assets): The total Assets which is used as proxy for size of an MFI is strongly significant and positively associated with operational sufficiency. It indicates that size of the MFIs is highly important indicator influencing financial sufficiency of Microfinance institutions. It suggests that change in size of MFIs positively affects the operational sufficiency. The econometric findings of regression revealed that for one unit increase in the size of MFI will increase the operational self-sufficiency ratio by (0.03) units. This means that increase in size (total assets) will lead to increase in operational self-sufficiency. Contrary to this reducing the size will lead to decrease in operational self-sufficiency. This finding is consistent with the Cull *et. al.* (2005) and (2007) whose econometric findings revealed that the size of MFI is significantly and positively related to operational self-sufficiency. Moreover, this finding is also consistent with Bogan *et. al.* (2007), Coleman and Osie (2008), Mersland and Strom (2009), Woldeyes (2012) Rahman and Mazlan (2014) their empirical findings revealed that size of MFIs is significantly and positively associated with operational self-sufficiency. In general, the findings do support the alternative hypothesis that size of MFIs positively related to operational self-sufficiency.

5.5.2.8 Age (log value): The age of an institution refers to the period that a MFI has been operational since it came into existence. The empirical findings of regression shows that age of an MFI is strongly significant at 1% level and negatively associated with operational self-sufficiency. It suggests that age of an MFI is an important variable influencing operational self-sufficiency indicating that age does improve its operational self-sustainability. It means experienced or older MFI's operational self-sufficiency is reducing with increasing age of MFIs. This finding does confirm the previous studies findings which found out that age of MFIs is negatively associated with operational self-sufficiency by Robinson (2001), Bogan *et .al.* (2007), Bogan (2012), Nadiya *et. al.* (2012), Nyamsogoro (2010), Rahman and Mazlan (2014). This finding is contrary to findings of Cull *et. al.* (2007) found that age of MFIs is positively associated with operational self-sufficiency. Therefore, on the basis of the findings, the alternative hypothesis articulated as Age of MFIs is positively related with operational self-sufficiency is rejected.

5.5.3 Findings and discussion of Portfolio at Risk model: The factors affecting repayment rates performance is examined by using portfolio at risk (30) days as

dependent variable and independent variable as yield on gross loan portfolio, average loan balance per borrower adjusted by GNI per capita, Gross loan portfolio to total assets ratio, Labour cost to assets ratio, Percentage of female borrowers, Age of MFIs since its existence, Total Assets.

5.5.3.1 Yield on gross loan portfolio: The study determine whether higher interest rates are associated with rising loan defaults by using yield on gross loan portfolio a measure of interest rates. The econometric findings of regression analysis show that the coefficient is strongly significant at 1% level and positively associated with Portfolio at risk. It indicates that Yield on gross loan portfolio is an important indicator influencing loan repayment performance of Andhra microfinance institutions. The econometric result suggest that for one unit increase in Yield on gross loan portfolio i.e. interest rates, Portfolio at risk (30) days ratio is expected to increase by (0.68) units, holdings all other variable constant. It clearly indicates that increasing interest rates increases loan delinquencies. This findings is contrary to the findings of Kar (2010) their empirical findings show that yield on gross loan portfolio is negatively associated with portfolio at risk. The study of Cull *et. al.* (2007) found that loan delinquencies are more common for individual based lenders that charge high interest increasing rates as predicted by the theory. The finding of individual based lenders is similar to the result of positive association of yield on gross loan portfolio. However, the result contradict with the findings for solidarity and Village bank lenders MFIs. The finding do validate the alternative hypothesis articulated as yield on gross loan portfolio is positively associated with portfolio at risk.

5.5.3.2 Average loan size per borrower adjusted by GNI per capita: The average loan size (a measure of depth of outreach) is strongly significant and negatively associated with portfolio at risk in most appropriate model i.e. pooled model. This means that average loan size adjusted by GNI per capita is an important variable influencing loan repayment rates. It indicates that increasing average loan size sharply reduces loan delinquencies. Andhra microfinance institutions are performing better in terms of loan repayment performance when their average loan size is increasing. This finding is contrary to the findings of Kar (2010) whose empirical findings found that average loan size and portfolio at risk (30) days relationship is insignificant. In

general, the empirical findings do validate the alternative hypothesis of negative relationship with portfolio at risk.

5.5.3.3 Gross loan portfolio to total assets ratio: The econometric findings of pooled OLS model show that the coefficient is positively and insignificantly associated with portfolio at risk. It means that gross loan portfolio to total assets ratio is not an important determinant of portfolio at risk. This finding is consistent with findings of Kar (2010) whose empirical findings showed that average loan balance (GNI adjusted) is an insignificant predictor of portfolio at risk. The results contradict with Cull *et. al.* (2007) whose findings revealed that gross loan portfolio to total assets ratio is significantly and positively related to portfolio at risk. Therefore, on the basis of this finding, the null hypothesis framed as there is no significant relationship between gross loan portfolio to total assets ratio and portfolio at risk is accepted.

5.5.3.4 Labour cost to assets ratio: The result of regression analysis shows that the coefficient is highly significant and negatively associated with portfolio at risk. It means that the labour cost to assets ratio is an important variable influencing loan repayment rates of SeeemAndhra Microfinance institutions. It indicates that increasing labour cost to assets ratio reduces loan delinquencies of semAndhra microfinance institutions. This finding is contrary to the findings of Cull *et. al*. (2007) and Kar (2010) their empirical findings show that labour cost to assets is an insignificant predictor of portfolio at risk ratio. The empirical findings of regression do reject the alternative hypothesis of no significant association between portfolio at risk and labour cost to assets ratio.

5.5.3.5 Percentage of women borrowers: The percentage of women borrowers is a measure of depth of outreach since women in poor countries are considered poorest of poor in general. The result of regression analysis shows that the coefficient of percentage of women borrower is highly significant and negatively associated with portfolio at risk. It means that percentage of women borrowers is an important indicator influencing loan repayment rates. The empirical findings suggest that increasing share of women clients reduces loan delinquencies of Andhra microfinance institutions. This finding is in the line with Crombrugghe *et. al.* (2008) whose findings revealed that percentage of women borrower is significantly and negatively associated with portfolio at risk. However, this finding is contrary to the Kar (2010) whose

findings show that the percentage of women clients is an insignificant predictor of portfolio at risk 30 days. Crabb and Keller (2006) empirical findings is contradictory with the finding of positive association. They concluded that greater lending to women consistently raises the risk of the portfolio. This finding does confirm the alternative hypothesis articulated as percentage of women borrowers is expected to be negatively associated with portfolio at risk.

5.5.3.6 Age (log value): The age of microfinance institutions refers to the period an MFI has been in operational since it came into existence. The result of regression analysis shows that the coefficient of age MFIs is insignificant and positively associated with portfolio at risk. It means that age is not a significant variable influencing portfolio at risk. This finding is consistent with the findings of Kar (2010); Nyamsogoro (2010); Cull *et. al.* (2005) and (2007) observed that age of an institution is an insignificant variable influencing portfolio at risk. This finding is also contrary to the findings of Crombrugghe *et. al.* (2008) found that age is significantly and negatively related to portfolio at risk. Therefore, on the basis of this finding the alternative hypothesis articulated as age of an institution is positively associated with portfolio at risk remains rejected.

5.5.3.7 Size (log Assets): Log Assets is a proxy used for size of MFIs. The empirical findings of regression analysis show that the size of an MFI is insignificantly and positively related to portfolio at risk. This suggests that size of MFIs is not an important predictor influencing portfolio at risk of Andhra microfinance institutions. This finding is consistent with the findings of Cull *et. al.*. (2005) and (2007) and Nyamsogoro (2010) observed that size of an institution is an insignificant variable influencing portfolio at risk (30) days. In general, findings do reject the alternative hypothesis of positive association between size of MFIs and portfolio at risk.

5.5.4 Findings and Discussion of depth of outreach to female client's model

The percentage of loan extended to women is reliable measure of depth of outreach. Women in developing countries are considered the poorest of the poor. The main goal of the microfinance from the very beginning is women empowerment and poverty elevation. Therefore, higher percentage of women borrower represents better outreach to the poor. From this perspective higher percentage of women clients in loan portfolio is considered as good indicator of outreach. Moreover, women borrowers

have better reputation and reliability for loan repayment. The econometric findings of most appropriate model i.e. Fixed effect model as per result of panel diagnostic revealed that financial self-sufficiency and capital cost to assets are insignificant. This suggests that both factors are not important predictor of depth of outreach measured by percentage of female clients. The coefficient of gross loan portfolio to total assets ratio is significantly and negatively associated with depth of outreach. This finding is quite similar to the findings of Kar (2010). This finding confirms that increasing portfolio at risk or loan delinquencies leads to reduction in terms of outreach to female clients as portfolio at risk is negatively associated with percentage of women clients at 10% level of significance. The coefficient of operational self-sufficiency is significant at 10% level and positively associated with operational self-sufficiency which indicates that improvement in operational sufficiency leads to increased outreach to female clients. The significant and positive association of age with outreach to female clients indicates that with increasing age or experienced MFIs are performing better in terms of outreach to women clients. However, the coefficient of size is significant at 10% and negatively associated with outreach, it indicates that with increasing size of MFIs outreach to female clients is reducing. The findings do not find evidence of Mission Drift i.e. tradeoff between sustainability and outreach to female clients as coefficient of FSS is insignificant and coefficient of OSS is positively associated at 10% significance level. It means that Andhra MFIs are attaining operational sufficiency without compromising with outreach to women borrowers.

5.5.5 Findings and Discussion of depth of outreach to poor clients (albpbg) model: The average loan size is generally used as a measure of depth of outreach. The econometric findings of regression revealed that the financial self-sufficiency and operational self-sufficiency ratio is positively related to average loan size. Though the coefficient of operational self-sufficiency is significant at 5% level and coefficient of financial self-sufficiency is insignificant. It suggests that improving financial performance is associated with loan sizes since larger loans are related to higher cost efficiency and ultimately higher profitability. The positive association of financial performance proxies with average loan size indicates mission drift where MFIs serves non-poor clients because lower loan size indicates better outreach to core poor. This

finding is also in line with Adongo and stork (2005) found that profitability is positively related with average loan size i.e. selling bigger loan size. However, Cull *et. al*. (2007) argue that institutions that make smaller loans are not less profitable on average compared to those making bigger size loans and inclined to a conclusion that profitability and depth of outreach to poor cannot be attained simultaneously. The coefficient of capital cost to total assets ratio is highly significant at 1% level and negatively associated with depth of outreach to poor. It indicates that MFIs with higher capital cost to total assets ratio provides smaller loan amount. However, other indicators such as age, size, portfolio at risk, and gross loan portfolio to total assets ratio show insignificant negative relationship with depth of outreach.

5.6 CONCLUSION

This chapter states about the descriptive statistics and regression results of Financial self-sufficiency, Operational self-sufficiency, portfolio at risk and outreach model of women clients and poor by pooled OLS, fixed effect and Random effect models of panel data. To check consistency, all the three models of panel data are employed. However, results and interpretation are based on a most appropriate model which is chosen by applying F test, Breusch pagan test and Hausman test. Gretl software is used to generate the results of panel data models and result of tests. This chapter also discusses how to deal with the normality, linearity, multicollinearity, autocorrelation and heteroscedasticity in order to satisfy assumptions of regression analysis. The panel diagnostic command is used to generate the result of F test, Breusch pagan test and Hausman test. On the basis of the result of panel diagnostic command which suggests pooled OLS regression technique is suitable to estimate portfolio at risk (P30) and outreach to female clients (POFB). Fixed effect regression technique is suitable for financial self-sufficiency (FSS) and operational self-sufficiency (OSS) model. Random effect regression technique is suitable for depth of outreach to poor clients (albpbg) model. The findings of financial self-sufficiency and operational self-sufficiency models reveal that important factors influencing operational and financial self-sustainability are yield on gross loan portfolio, portfolio at risk (30) days, size and age. Furthermore, the important determinants of loan repayment performance are yield on gross loan portfolio, average loan balance per borrower adjusted by GNI per

capita, labour cost to assets ratio and percentage of female clients. The empirical findings confirm that preference of MFIs to the female customer when repayment risk is higher has no statistical basis in POFB model. The econometric findings revealed that financial self-sufficiency, operational self-sufficiency, age, portfolio at risk (30) days, capital cost to assets are insignificant predictors of depth of outreach to female clients. The findings of ALBPBG model suggests that improving financial performance is associated with larger size loans. The positive and strongly significant association of financial performance proxies with average size loan indicate mission drift where MFIs serve non-poor clients because lower or small loan size indicates better outreach to poor.

The next chapter discusses in detail the findings and conclusion of the study. On the basis of findings, suggestions and directions for future research have been stated briefly for the future researcher to cover this topic from other dimensions that have not been taken in the present research work.

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6.0 CONCLUSION

This chapter discusses the interpretation and suggestions withdrawn from results and findings of various models of factors affecting financial self sufficiency, operational self sufficiency and portfolio at risk, depth of outreach to poor and women borrower models by pooled OLS, fixed effect and random effect regression models of panel data. In order to check consistency, the study employed all the three model data. However, discussion and findings are based on a most appropriate model which is chosen by applying F test, Breusch pagan test and Hausman test. The study also highlights the important limitations and further research direction in this chapter. The present study is quantitative and fact finding research that tries to investigate determinants of financial self sufficiency, operational self sufficiency and loan repayment performance. Secondly, the present research also investigated about the social mission of microfinance institutions i.e. determinants of the depth of outreach to poor and women clients and trade off between outreach and financial self sufficiency. In order to accomplish the first objective of the study, detailed review of prior theoretical and empirical research studies have been undertaken to identify the most important determinants of financial self sufficiency, operational self sufficiency, portfolio at risk and factor affecting depth of outreach to poor and women clients. The extensive and exhaustive review of literature guided to the direction and insight into various factors affecting MFIs financial and social performance are considered for this study. The most important Microfinance institutions specific determinants of operational and financial self sufficiency that have been included are yield on gross loan portfolio, capital cost to assets ratio, gross loan portfolio to assets ratio, average loan balance per borrower, portfolio at risk (30) days, labour cost to assets ratio, size and age of MFIs. Similarly on the basis of in-depth review, the important Microfinance institutions specific determinants affecting loan repayment performance are yield on gross loan portfolio, average loan balance per borrower adjusted by GNI per capita, gross loan portfolio to total assets ratio, labour cost to assets ratio, percentage of female clients, age and size of MFIs. In order to analyse social mission of MFIs and tradeoff between social and financial performance. The study included Percentage of female borrowers and average loan balance per borrowers, adjusted by GNI per capita to measure the depth of outreach to female clients and poor. On the basis of prior literature, the variables included to identify tradeoff and depth of

outreach are financial self sufficiency, operational self sufficiency, age, size, portfolio at risk, capital cost to assets ratio and gross loan portfolio to total assets ratio. Based on the panel diagnostic test i.e. (F test, Breusch pagan test and Hausman test) show that Pooled OLS technique is suitable for estimating Portfolio at risk (P30) and outreach to female clients (POFB) model. Fixed effect regression model is suitable for operational self sufficiency (OSS) and financial self sufficiency (FSS) model. Random effect regression technique is suitable for outreach to poor clients model (albpbg). The first section (6.1) of this chapter discusses the conclusions made on the basis of operational and financial self sufficiency model. Section (6.2) is the concluding part of factor affecting loan repayment performance model of Microfinance institutions in Andhra Pradesh. Section (6.3) concludes about the empirical findings of the tradeoff between outreach to poor model and financial viability and the tradeoff between outreach to women and financial viability model. The four conclusion sections are followed by the section (6.4) about implications of the conclusion made a summary of key contribution analysed in this study. Section (6.5) states important recommendations given on the basis of important empirical findings and results of this study. Section (6.6) is about the important areas open for future research.

6.1 IMPORTANT DETERMINANTS OF OPERATIONAL AND FINANCIAL SELF SUFFICIENCY OF ANDHRA'S MFIS.

This section presents the important determinants of operational and financial self sustainability of Microfinance institutions of Andhra Pradesh. The findings of the study revealed that the important determinant of operational and financial self sustainability are yield on gross loan portfolio, portfolio at risk (30) days, size and age. The p values of independent variables are highly significant at 1% level in both FSS and OSS model only portfolio at risk is significant at 5% level in FSS model. However labour cost to assets ratio, average loan balance per borrower, gross loan portfolio to total assets ratio and capital cost to assets ratio are insignificant predictors of operational and financial self sufficiency. The findings of yield on gross loan portfolio are consistent with the study of Nyamsogoro (2010) and Crombrugghe *et. al.* (2008) found that yield on gross loan portfolio significantly and positively affects the financial performance. The finding of the portfolio at risk is consistent with the

findings of Nyamsogoro (2010) & Ayayi and Sene (2010) concluded that there is negative association between portfolio at risk and financial sustainability. The finding of the size of MFI is significantly and positively associated with financial sustainability is in line with Cull *et. al.* (2007), bogan *et. al.* (2007), Nadolyak *et. al.*((2007), Coleman and Osie (2008) & Robinson (2001). However, it contradicts with the findings of Hartarska (2005). Findings of the age of MFI contradicts to the Nadiya (2011), Nyamsogoro (2010) and Cull *et. al.* (2007) found that age is not a significant factor influencing financial self sufficiency. The findings of yield on gross loan portfolio that increasing interest rates are associated with improved financial performance are consistent with Crombrugghe *et. al.* (2008), Cull *et. al.*(2007) and Nyamsogoro (2010). The findings of the portfolio at risk is consistent with findings of Kar (2010) found that portfolio at risk is negatively associated with operational sustainability. The findings of size that increase in size will lead to increase in operational sustainability is in line with Bogan *et. al.* (2007), Coleman and Osie (2008), Mersland and Storm (2009), Cull *et. al.* (2007), Woldeyes (2012) & Rahaman and Mazalan (2014).The findings of the age that older MFIs operational self sufficiency is reducing are consistent with Bogan *et. al.* ((2007), Bogan *et. al*. (2012) Nadiya (2011) Nyamsogoro (2010) Rahman and Mazlan (2014) and against the findings of Cull *et. al.* (2007).

6.2 DETERMINANTS OF PORTFOLIO OF RISK (30) DAYS MEASURE OF LOAN REPAYMENT PERFORMANCE.

This section discusses about the loan repayment performance of MFIs in Andhra Pradesh. The inference is that the important determinants of loan repayment performance are yield on gross loan portfolio, average loan balance per borrower adjusted by GNI per capita, labour cost to assets ratio and percentage of female clients. The p value of these variables is strongly significant at 1% level. However, gross loan portfolio to total assets ratio, age and size are insignificant predictors of loan repayment performance. The findings that increasing interest rates are increasing loan delinquencies are consistent with Cull *et. al.* (2007) and contradicts with Kar (2010). The findings that increasing average loan size reduces loan delinquencies is contradictory with Kar (2010). The findings that heavily spending on labour cost is contrary to the findings of Cull *et. al.* (2007) and Kar (2010). The findings of women

borrowers revealed that increasing share of woman clients reduces loan delinquencies. This finding is in line with Crombrugghe *et. al.* (2008). However, it contradicts with the findings of Kar (2010) and Crabb and Keller (2006).

6.3 TRADEOFF BETWEEN FINANCIAL VIABILITY AND DEPTH OF OUTREACH TO POOR AND WOMEN CLIENTS.

This section states about the tradeoff between financial viability and outreach to poor and women clients. The empirical findings confirm that preference of MFIs to the female customer when repayment risk is higher has no statistical basis in POFB model. Capital cost to Assets and operational self sufficiency both are not the important predictor of depth of outreach to female client's model. Increasing loan delinquencies leads to reduction in terms of outreach to female clients as portfolio at risk is negatively associated with outreach to female clients. The significant and positive association of age with outreach to female clients indicates that experienced MFIs performing better in terms of outreach to women clients. However, the coefficient of size is significant at 10% and negatively associated with outreach, it indicates that with increasing size of MFIs outreach to female clients is reducing. Gross loan portfolio to total assets ratio is negatively significant at 10% level with depth of outreach to female clients. This finding is in line with Kar (2010). The findings do not confirm the evidence of trade off between sustainability and outreach to female clients. The findings of ALBPBG model suggests that improving financial performance is associated with larger size loans. The positive and strongly significant association of financial performance proxies with average size loan indicate mission drift where MFIs serve non-poor clients because small loan size indicates better outreach to poor. This finding is consistent with Adongo and stork (2005) whose findings show that profitability is positively related with average loan size. However, age, size, portfolio at risk and gross loan portfolio to total assets ratio are insignificant predictor of depth of outreach to poor client's model. Moreover, the capital cost to total assets ratio is significantly and negatively associated with depth of outreach to poor.

6.4 CONCLUSIONS

- MFIs in Andhra Pradesh are operationally self sufficient but not financially self sufficient.
- MFIs in Andhra Pradesh have very high level of outreach to women clients which confirm MFIs devotion towards the social mission of woman empowerment.
- Andhra's MFIs portfolio at risk is very high which represents the repercussions of Andhra Microfinance crisis 2010.
- The important factors influencing operational and financial self sufficiency are yield on gross loan portfolio, portfolio at risk (30) days, size and age of MFIs.
- Increasing interest is strongly and positively associated with portfolio at risk i.e. increasing interest rates increases loan delinquencies.
- Age of MFIs is significantly and positively associated with outreach to female clients. It indicates that with increasing age of MFIs, outreach towards female clients is also increasing.
- The findings did not confirm the tradeoff between sustainability and outreach to female clients. It means that Andhra MFIs are attaining operational sufficiency without compromising with outreach to women borrowers.
- The capital cost to total assets ratio is significantly and negatively associated with depth of outreach to poor. It indicates that MFIs with the higher capital cost to total assets ratio provides smaller loan amount.
- The women clients are reliable borrowers as the findings revealed that increasing share of women borrowers reduces loan delinquencies.
- The important factors influencing loan repayment performance are yield on gross loan portfolio, average loan balance per borrower adjusted by GNI per capita, labour cost to assets ratio and share of female clients.
- The strongly significant and positive association of financial performance proxies with average loan size indicates mission drift where MFIs serve non poor clients i.e. not fulfilling the social objective of serving to unreached core poor clients.

6.5 IMPLICATIONS OF THE CONCLUSIONS MADE

The present research serves as an epitome for the research community, academicians and policy makers who search for recognising the importance of institutional factor in

an economy. The study is also important for executives as it predominantly shed light on MFIs specific factor related to financial viability, portfolio at risk, depth of outreach to poor and woman clients. This study serves as a guide for others as it broadens empirical evidence on Mission Drift i.e. Tradeoff between outreach to female clients and financial viability and trade off between outreach to poor and financial viability. Nevertheless, the present study offers following suggestions.

- To be financially sustainable Andhra's MFIs must charge optimum enough interest rates in order to cover not only for operating cost but also for the possible losses as a result of loan default. But, it must be done cautiously considering the impact of increasing loan interest rate on loan repayment and depth of outreach to poor clients.
- In order to maintain sustainability and higher depth of outreach to poor clients. MFIs must attract new customers by promotions and open new branches in rural areas as this would improve MFIs outreach and thereby improved financial performance and profitability.
- MFIs must improve their outreach to poor by providing relatively small amount loans. However, it will require having in place effective governance system to promote efficiency.
- The empirical findings confirm that increasing interest rates are associated with improved sustainability. On the other hand increasing interest rates leads to defaults in loan repayment performance. MFIs must charge optimum interest rates and increase profitability not by increasing interest rates but by increasing sales.
- The empirical findings confirm that size of an institution is significant achieving operational and financial self sufficiency. MFIs must increase their size.
- MFIs must focus on female clients as the findings proved that increasing share of women clients reduces loan delinquencies.
- MFIs must incur heavily on labour cost as the findings confirms that increasing labour cost reduces loan delinquencies.
- MFIs must establish proper code of conduct for field staff to recruit the required staff of right quality and make greater investment in training and supervision of field staff to prevent coercive methods of loan recovery.

- MFIs must improve performance, transparency and reporting by implementing industry best practices, upgrading management information system and payment and transfers via mobile phone.

6.6 AREAS FOR FUTURE RESEARCH

- Further study may be conducted on considering MFIs geographical location, growth stages, MFIs product delivery methodology and Institution design.
- Further study may be conducted on considering longer time period and large sample size of MFIs. This study is confined to 10 MFIs of Andhra Pradesh.
- Researchers and Microfinance practitioners can focus on other aspects such as program sustainability and human resource sustainability.
- Further empirical research should look at disaggregated MFIs data of microfinance lending models behaviour with sustainability and loan repayment performance.
- Financial viability of MFIs can be measured in several ways and by different proxy measures. However, only financial sustainability and operational sustainability are employed in this study to find out determinant of financial performance. So, further study may include different dependent and independent variables. It would be interesting to analyse the impact of other variables on financial and social performance.
- For analysing social mission of MFIs. The study included the percentage of female borrowers and average loan balance per borrower adjusted by GNI per capita for measuring the depth of outreach to female borrowers and female clients respectively. Further studies can include other proxies of social performance with other firm or MFI specific factor to look at the effect on social performance and the tradeoff between social performance and financial performance.
- Findings of this study may not be applicable to other Microfinance institutions in other states of India.
- Findings of this study may not be applicable to microfinance institutions in other countries.
- This study do not cover all the Microfinance institutions in Andhra Pradesh because some MFIs do not report data to MIX market.

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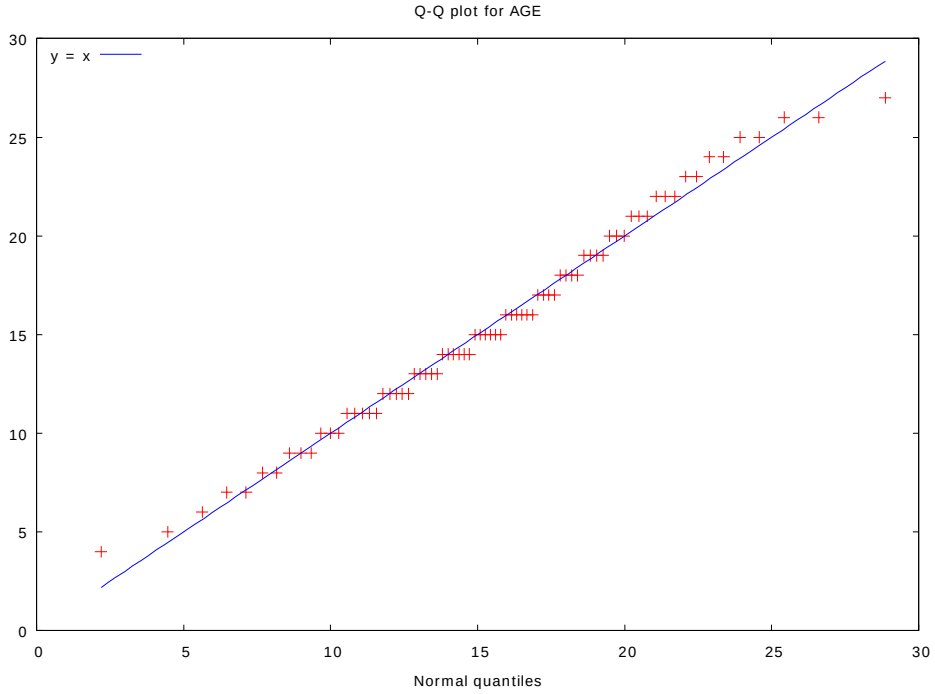
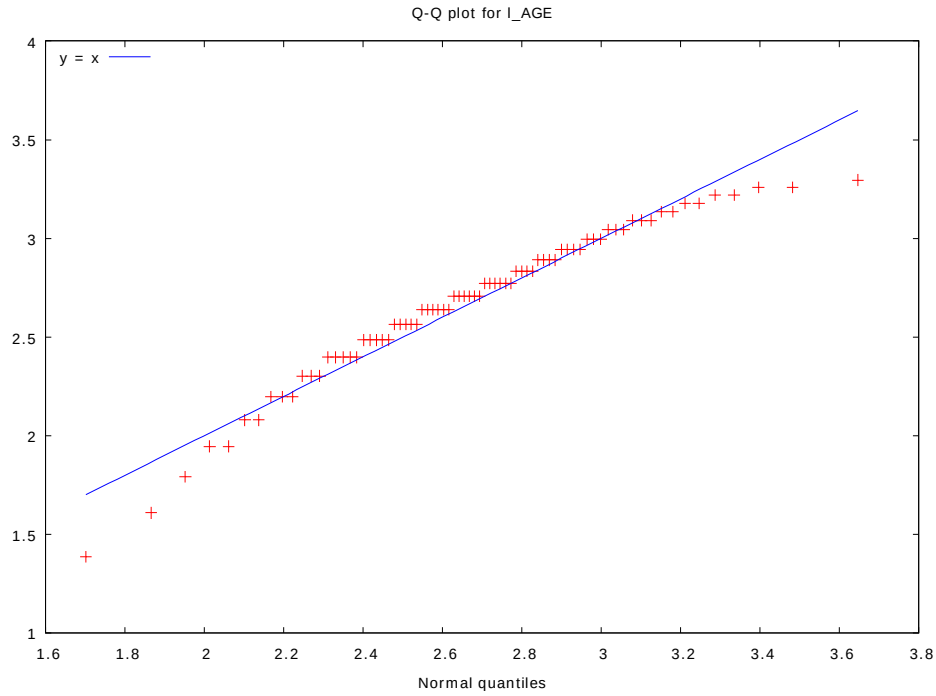
APPENDIX (A)

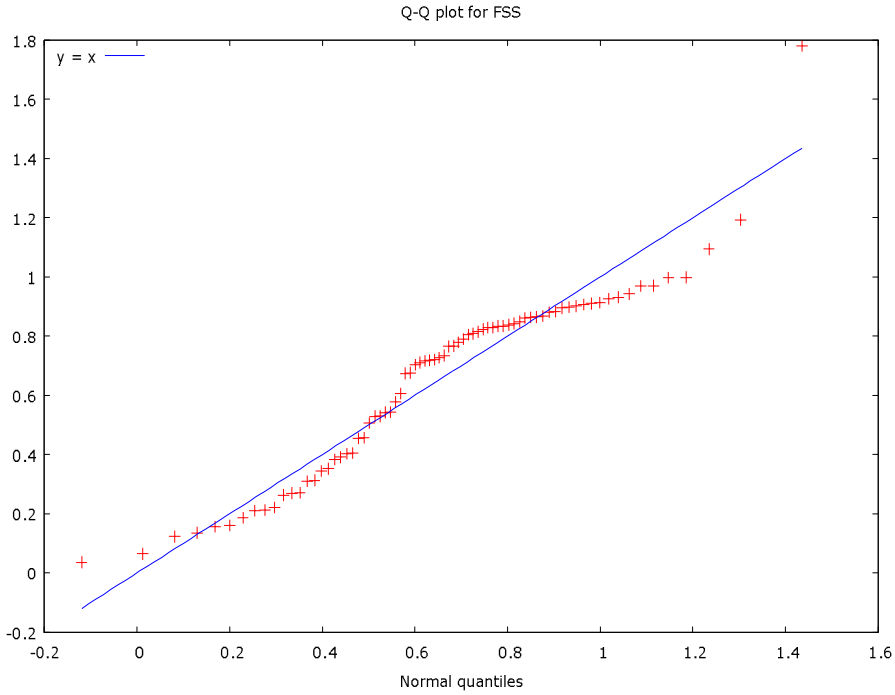
Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
FSS	.137	76	.001	.932	76	.001
AGE	.070	76	.200*	.986	76	.588
albpbg	.119	76	.009	.960	76	.017
yogp	.239	76	.000	.577	76	.000
ccta	.216	76	.000	.731	76	.000
glpta	.372	76	.000	.316	76	.000
oss	.193	76	.000	.896	76	.000
albpb	.107	76	.030	.967	76	.044
pofb	.410	76	.000	.481	76	.000
p30	.352	76	.000	.638	76	.000
pea	.093	76	.170	.960	76	.018
ass	.252	76	.000	.710	76	.000

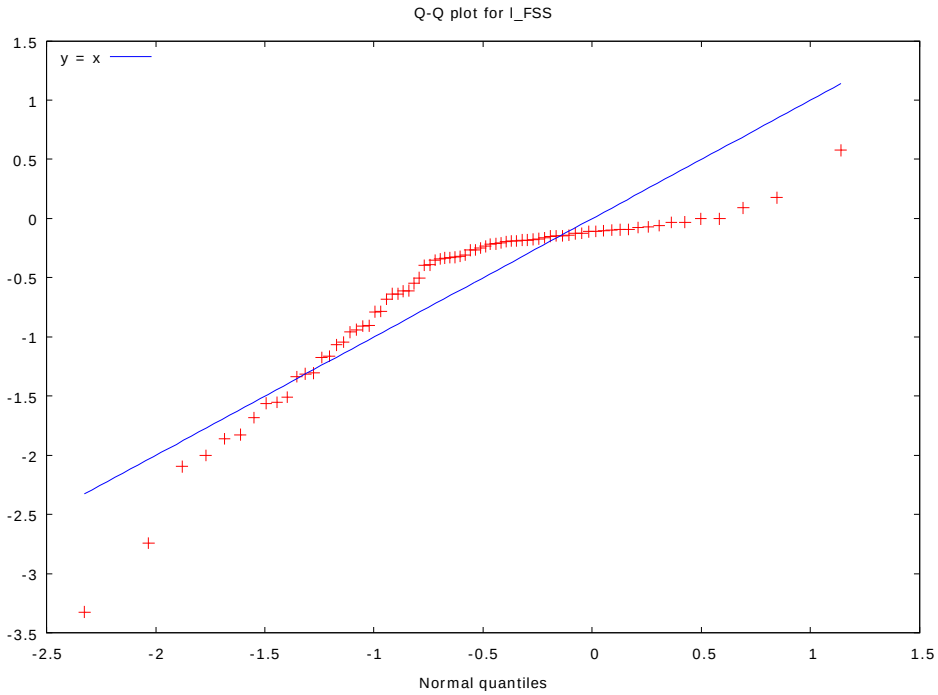
APPENDIX-B

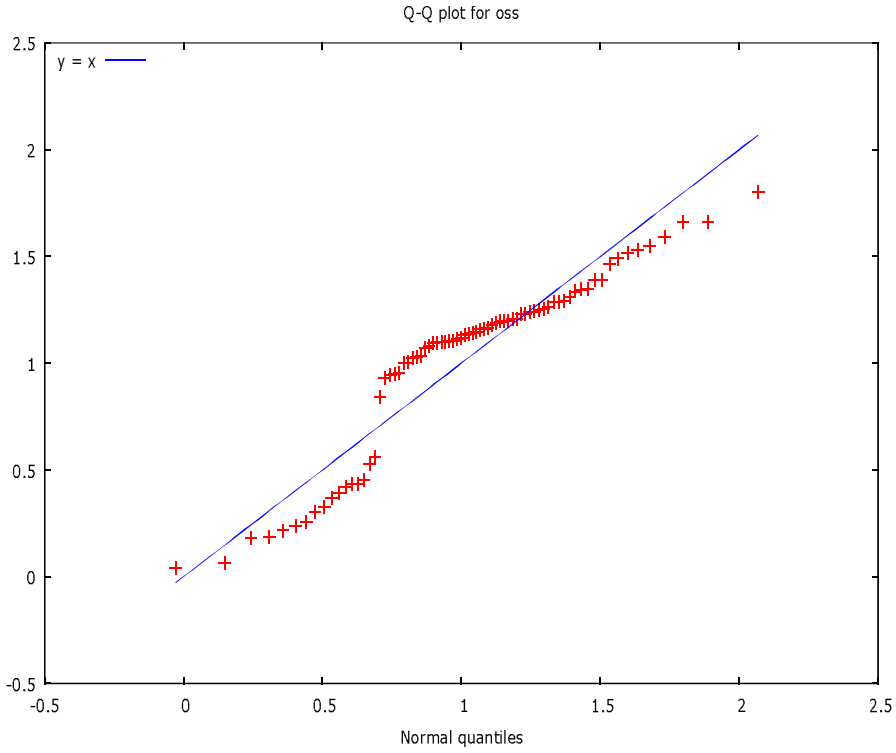
Q-Q Plots for Dependent and Independent Variables with Log and without Log

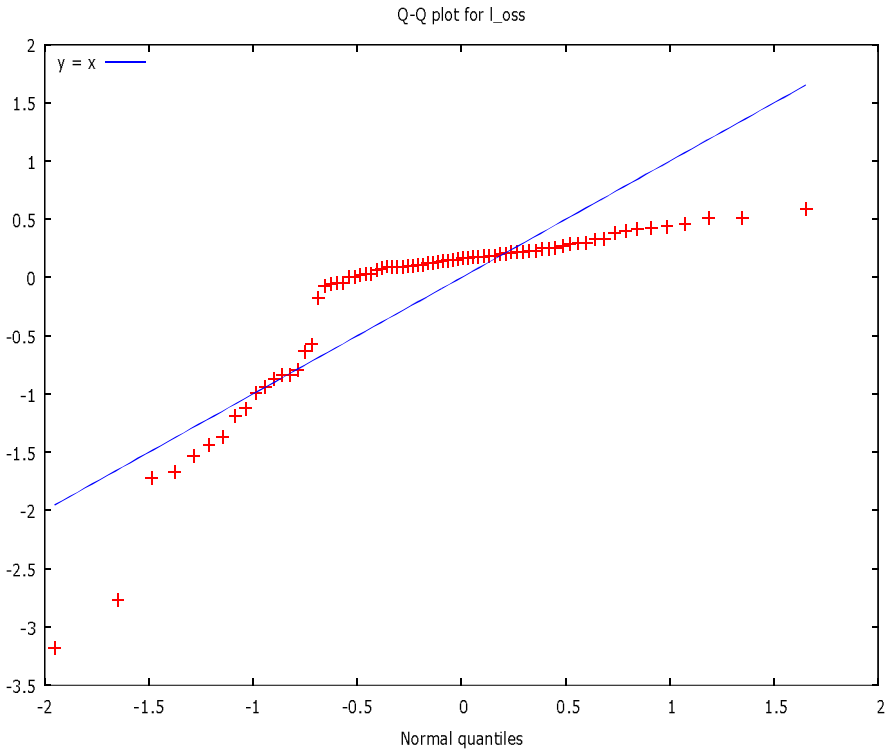


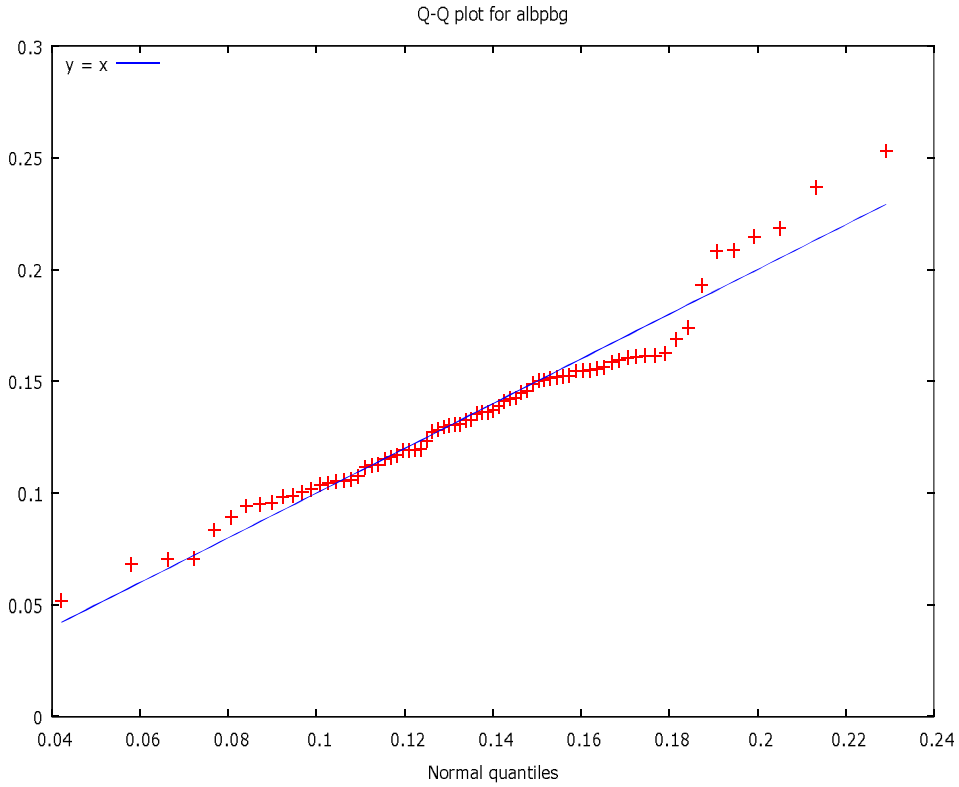


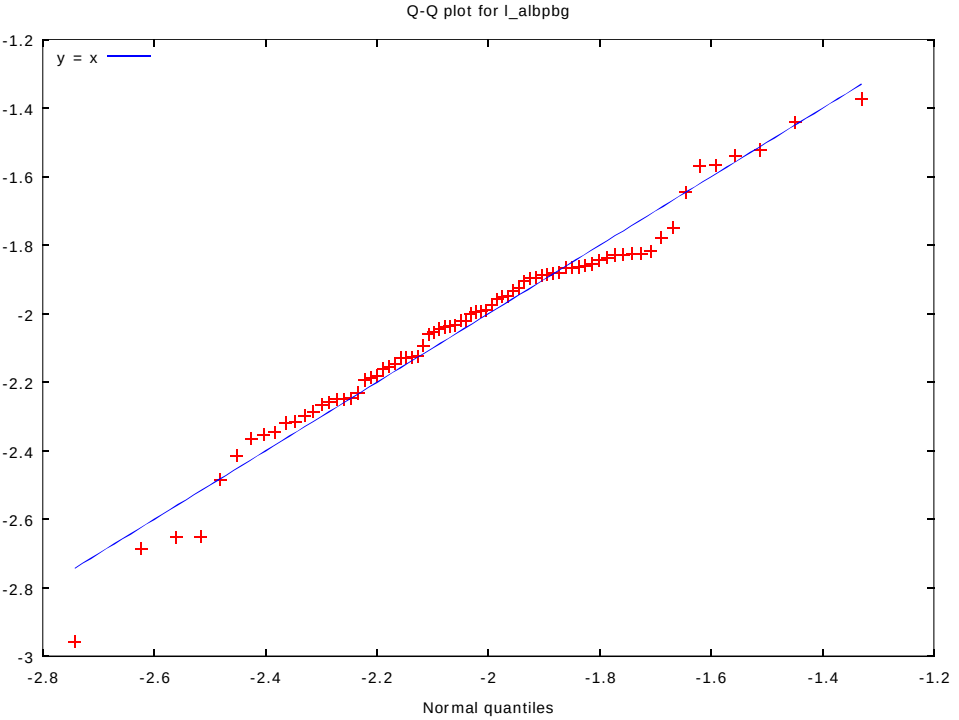

Q-Q plot for FSS
y = x
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Normal quantiles

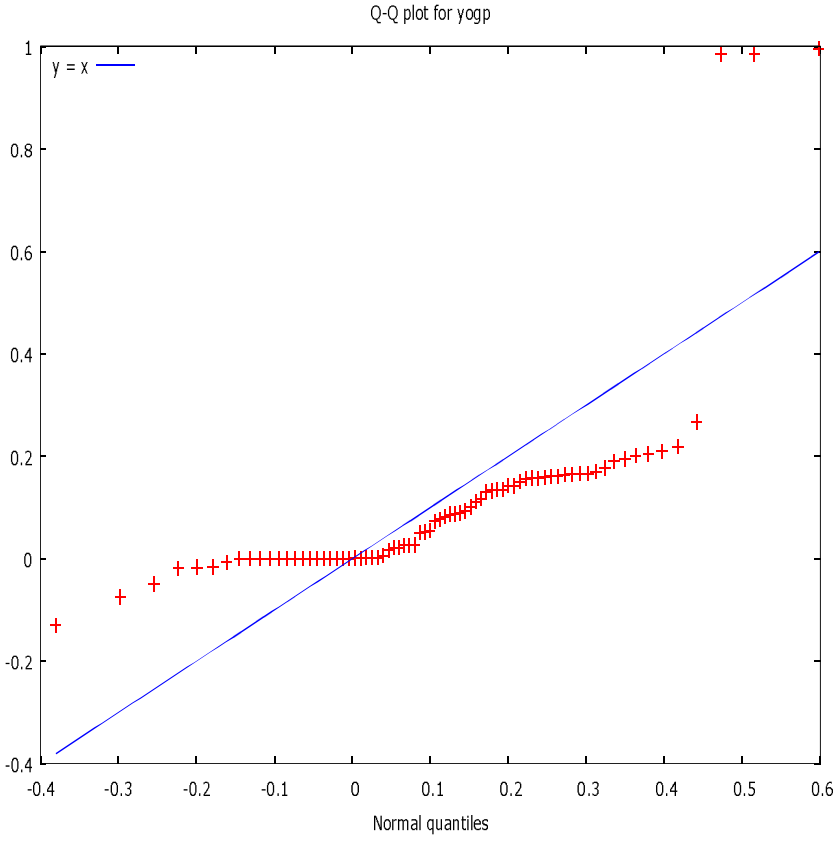

Q-Q plot for l_FSS
y = x
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
Normal quantiles

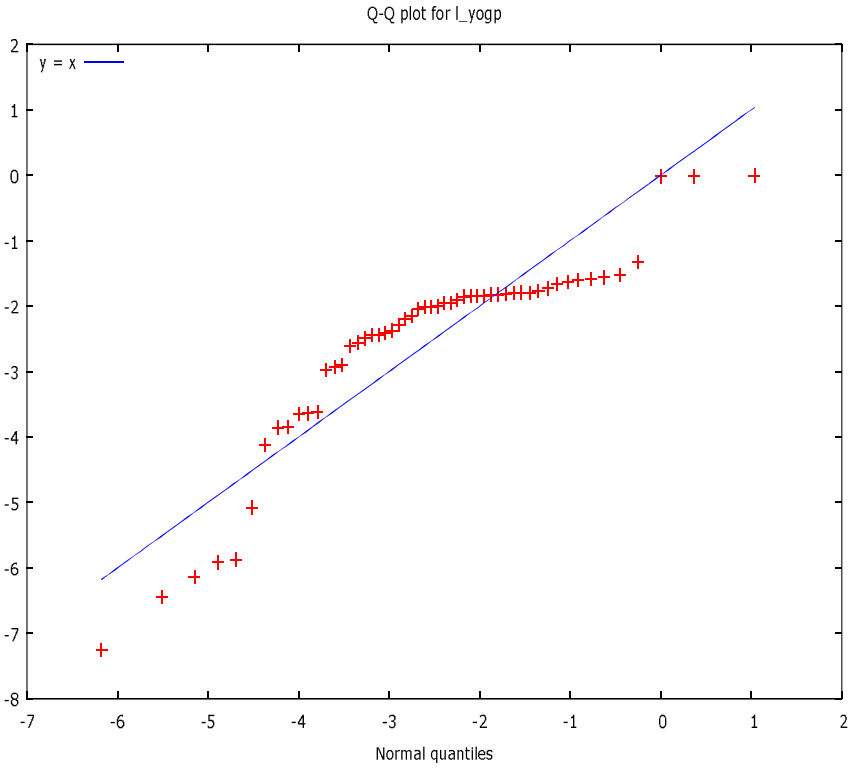

Q-Q plot for oss
y = x
2.5
2
1.5
1
0.5
0
-0.5
-0.5
0
0.5
1
1.5
2
2.5
Normal quantiles

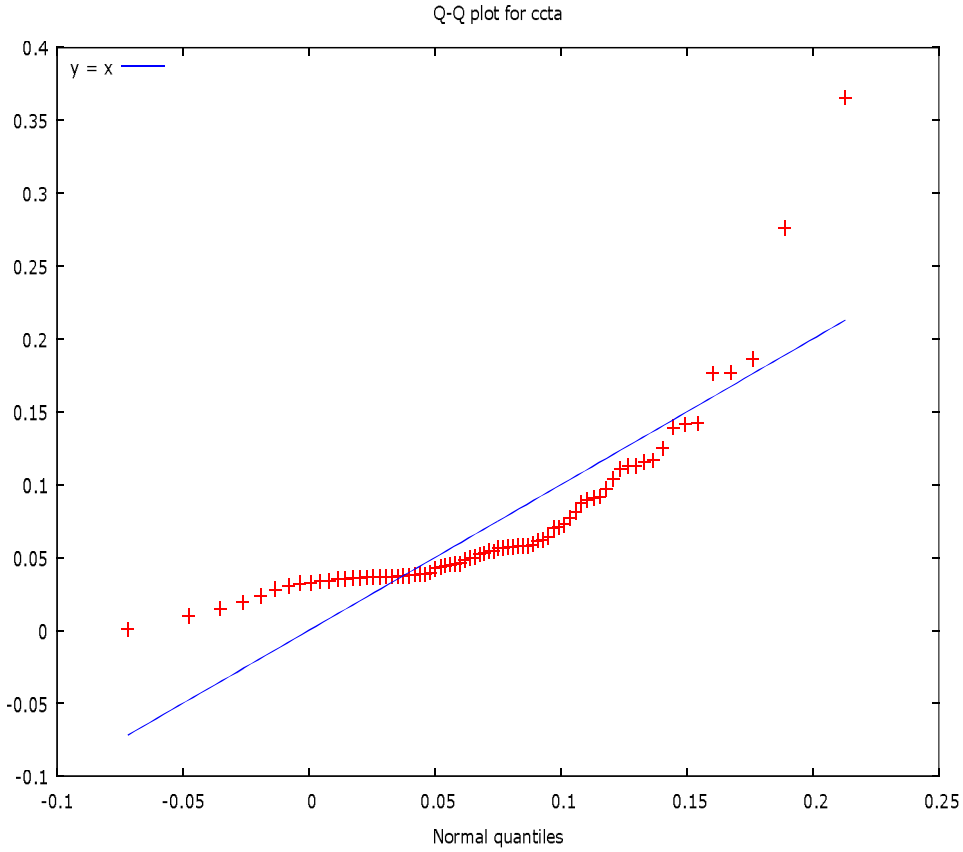

Q-Q plot for l_oss
y = x
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Normal quantiles

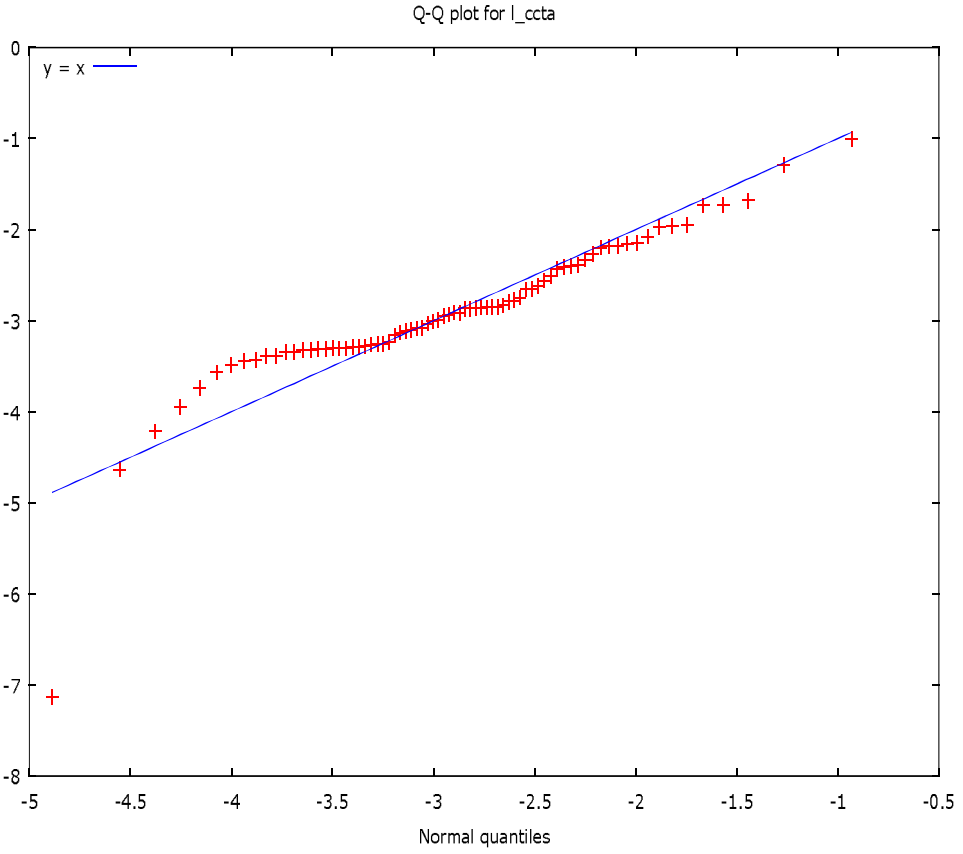

Q-Q plot for albpbg
y = x
0.3
0.25
0.2
0.15
0.1
0.05
0
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
Normal quantiles

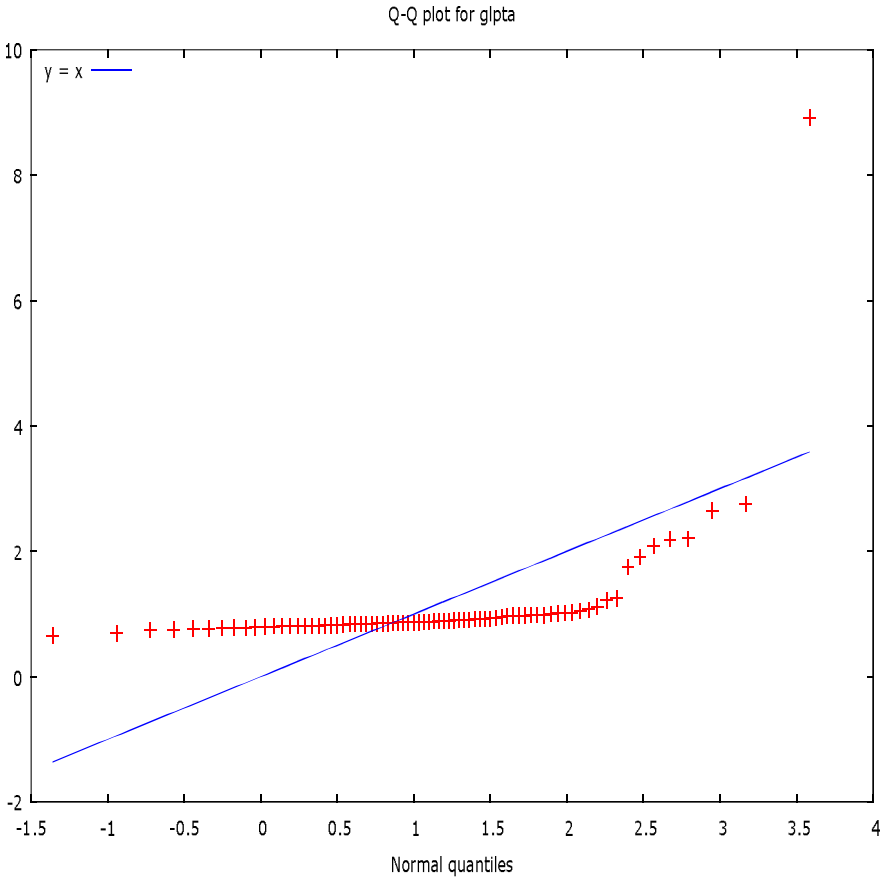

Q-Q plot for l_albpbg
y = x
-1.2
-1.4
-1.6
-1.8
-2
-2.2
-2.4
-2.6
-2.8
-3
-2.8
-2.6
-2.4
-2.2
-2
-1.8
-1.6
-1.4
-1.2
Normal quantiles

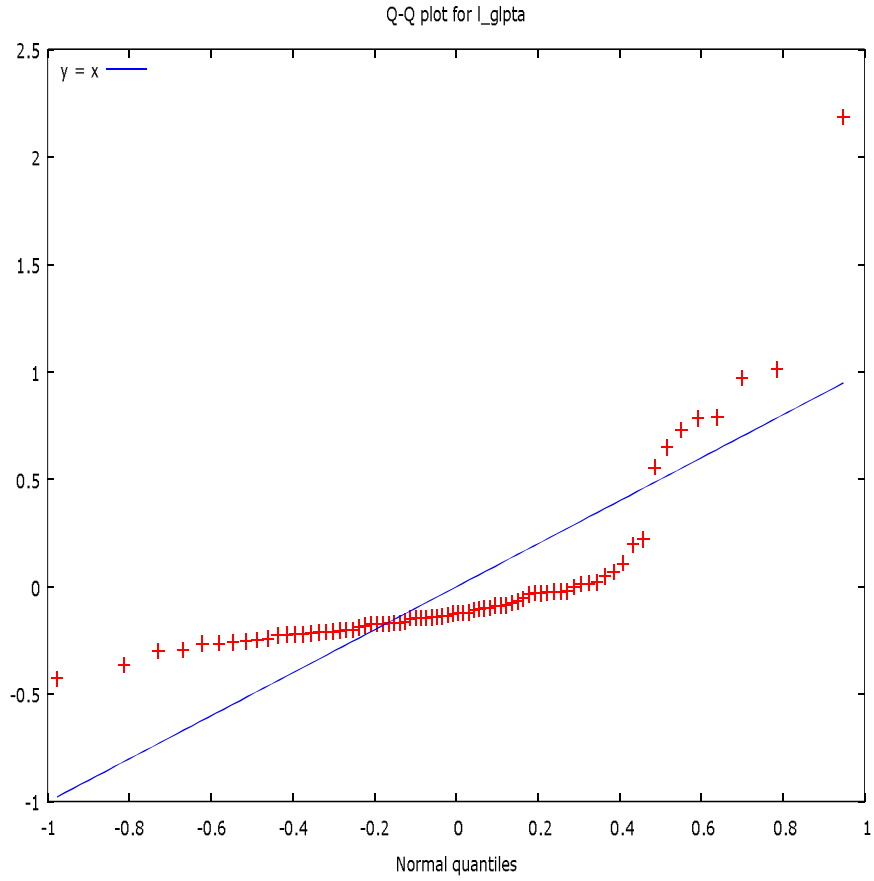

Q-Q plot for yogp
y = x
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
Normal quantiles

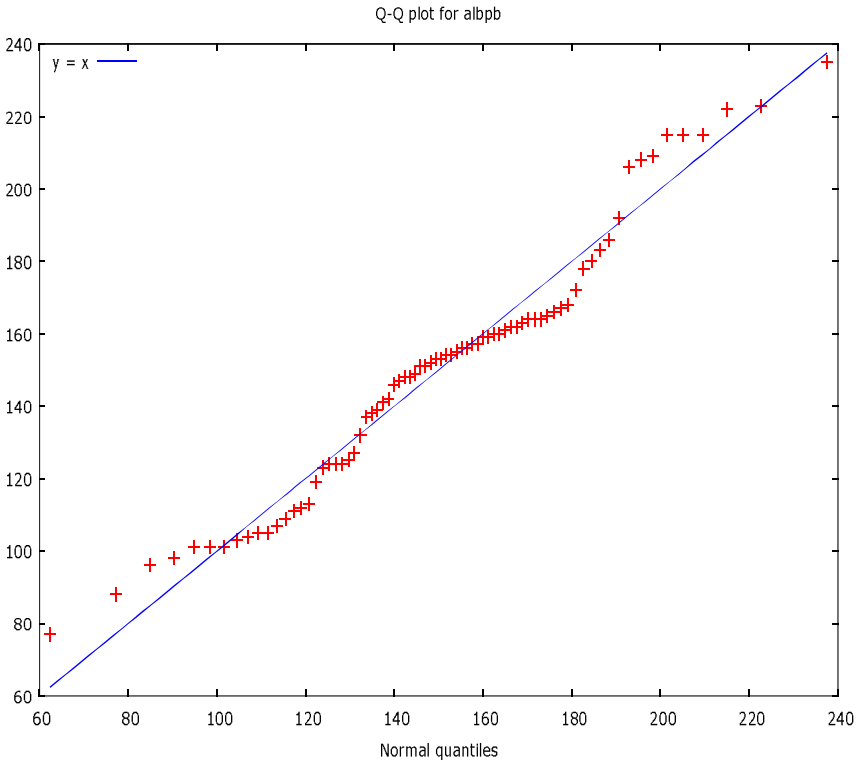

Q-Q plot for l_yogp
y = x
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
Normal quantiles

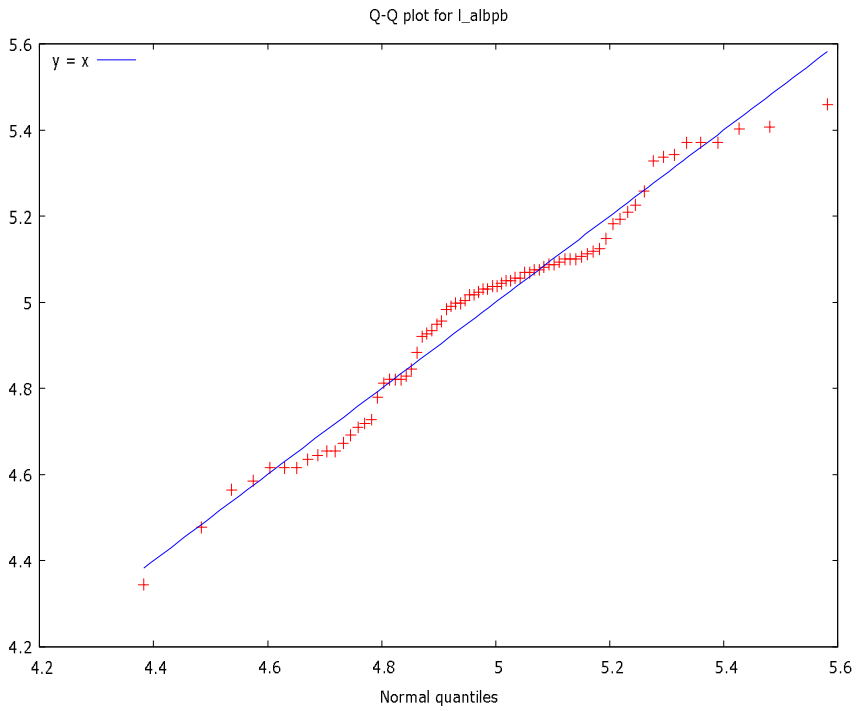

Q-Q plot for ccta
y = x
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
Normal quantiles

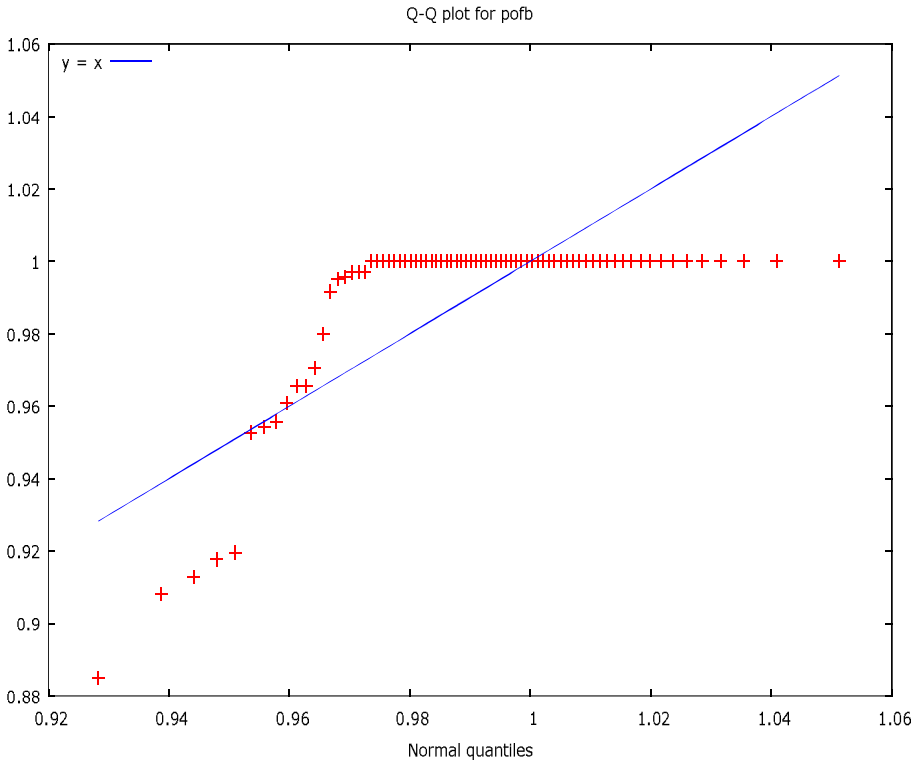

Q-Q plot for l_ccta
y = x
0
-1
-2
-3
-4
-5
-6
-7
-8
-5
-4.5
-4
-3.5
-3
-2.5
-2
-1.5
-1
-0.5
Normal quantiles

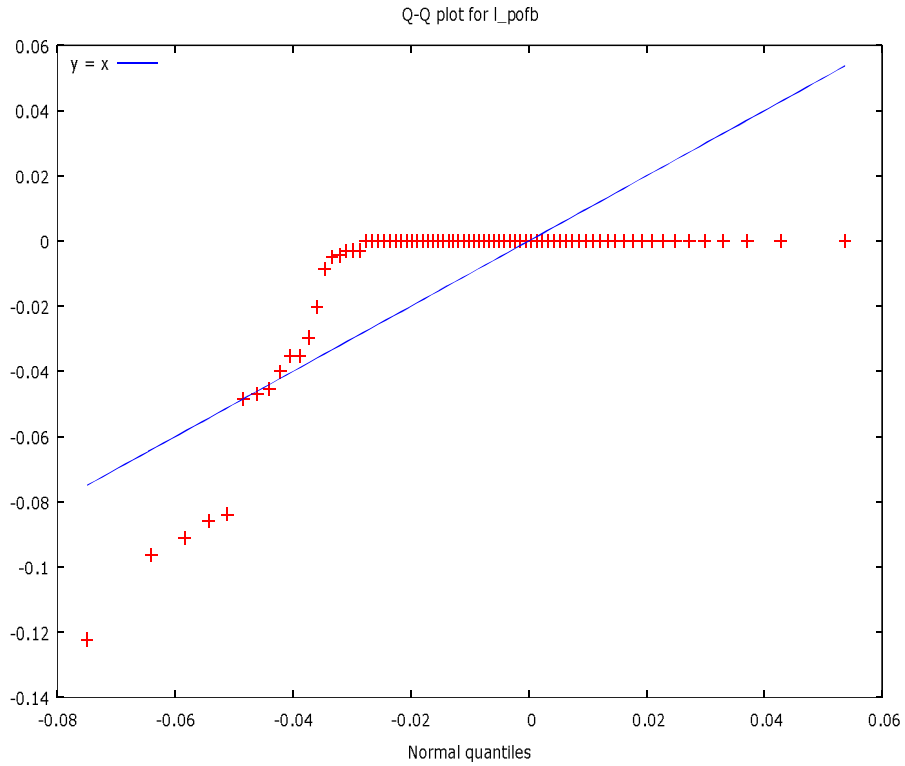

Q-Q plot for glpta
y = x
10
8
6
4
2
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
Normal quantiles

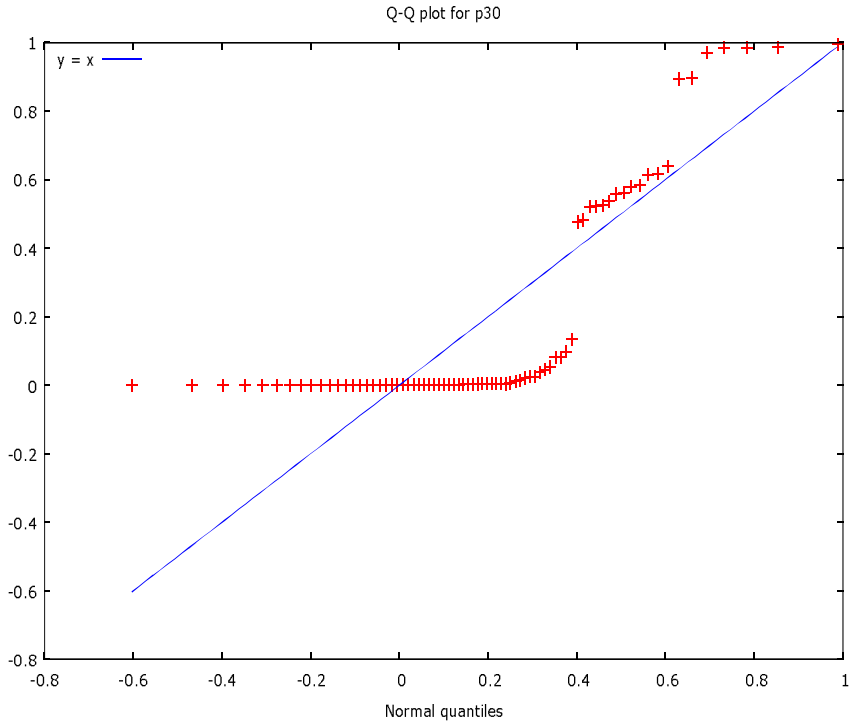

Q-Q plot for l_glpta
y = x
2.5
2
1.5
1
0.5
0
-0.5
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Normal quantiles

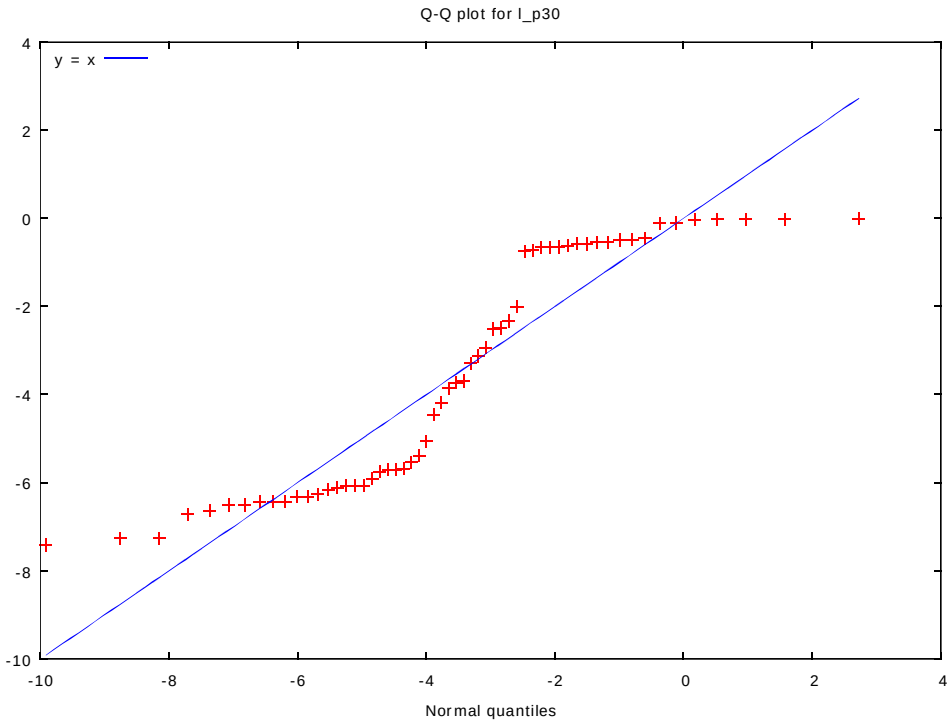

Q-Q plot for albpb
y = x
240
220
200
180
160
140
120
100
80
60
60
80
100
120
140
160
180
200
220
240
Normal quantiles

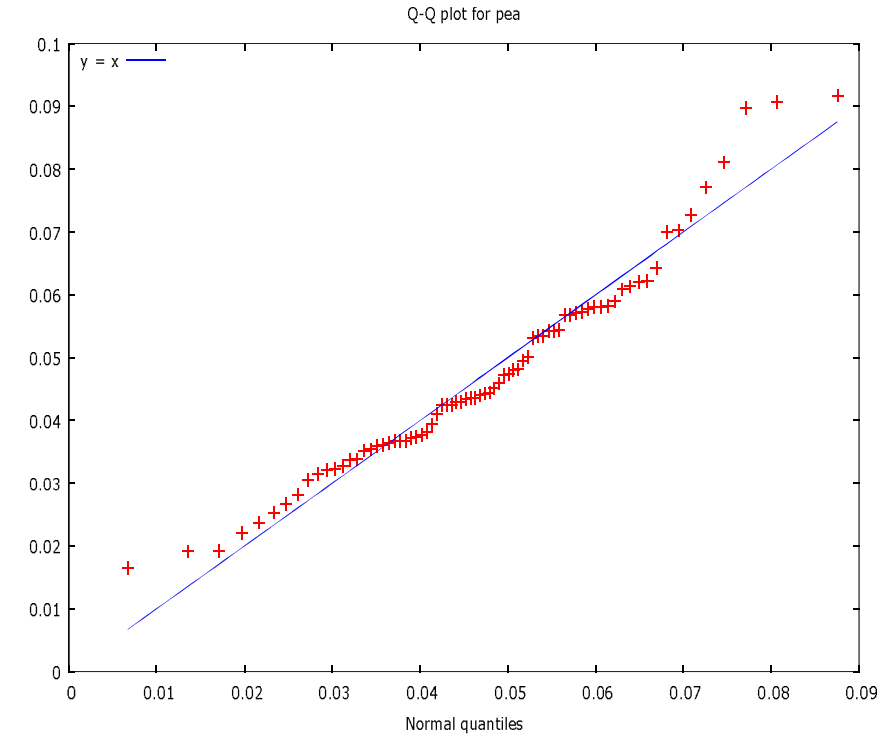

Q-Q plot for l_albpb
y = x
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
Normal quantiles

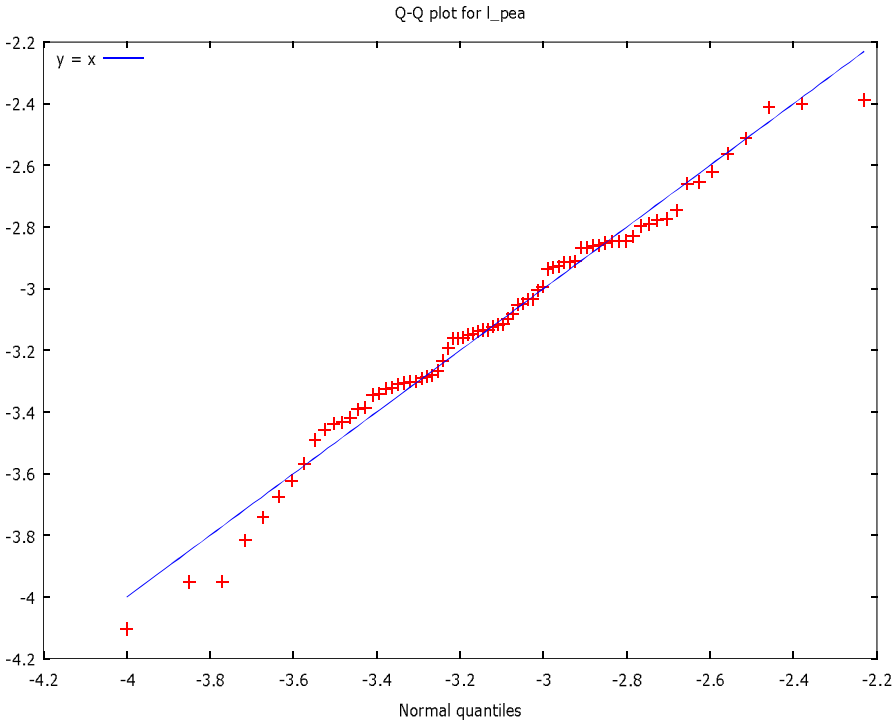

Q-Q plot for pofb
y = x
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
0.92
0.94
0.96
0.98
1
1.02
1.04
1.06
Normal quantiles

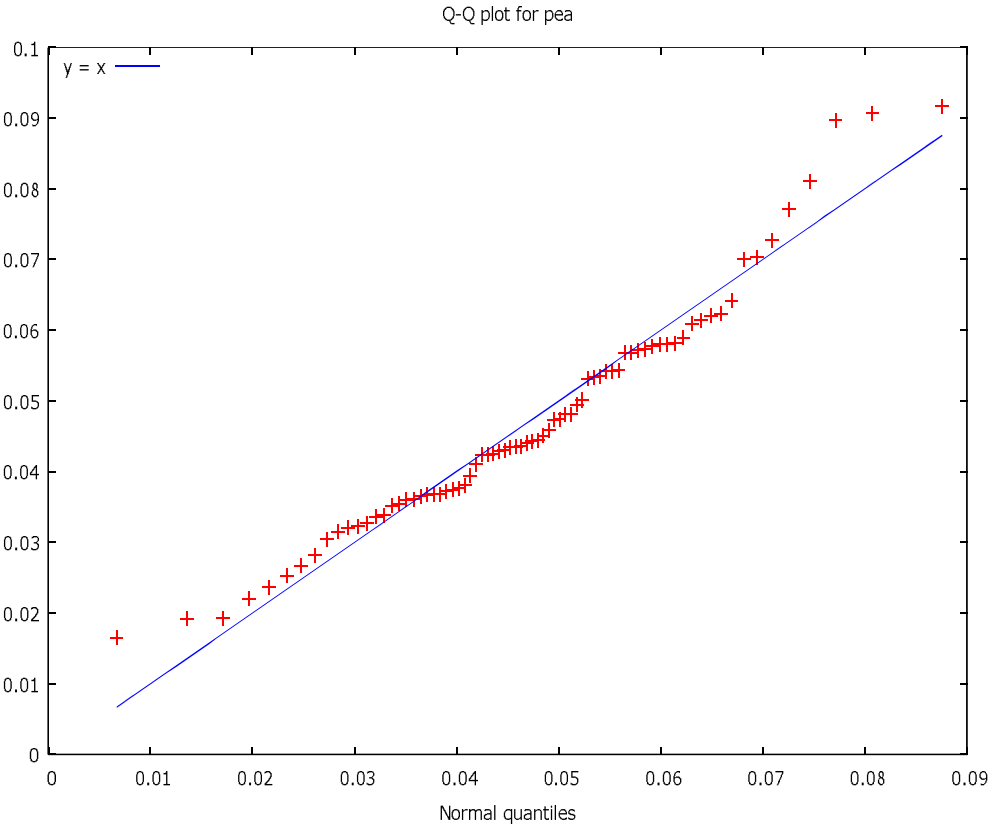

Q-Q plot for l_pofb
y = x
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.08
-0.06
-0.04
-0.02
0
0.02
0.04
0.06
Normal quantiles

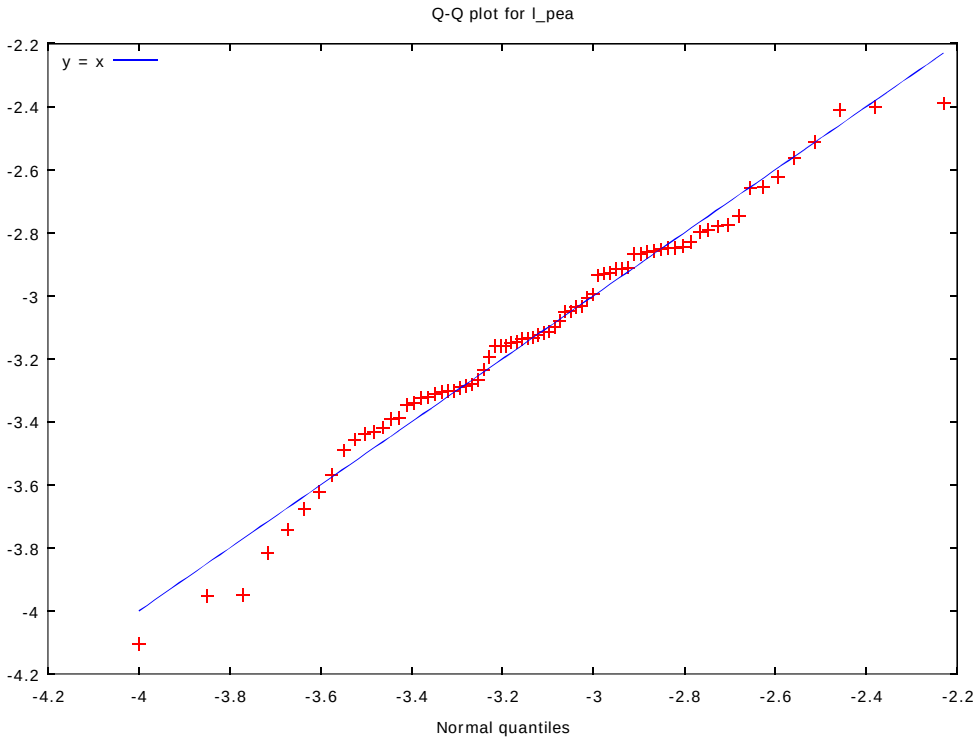

Q-Q plot for p30
y = x
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Normal quantiles

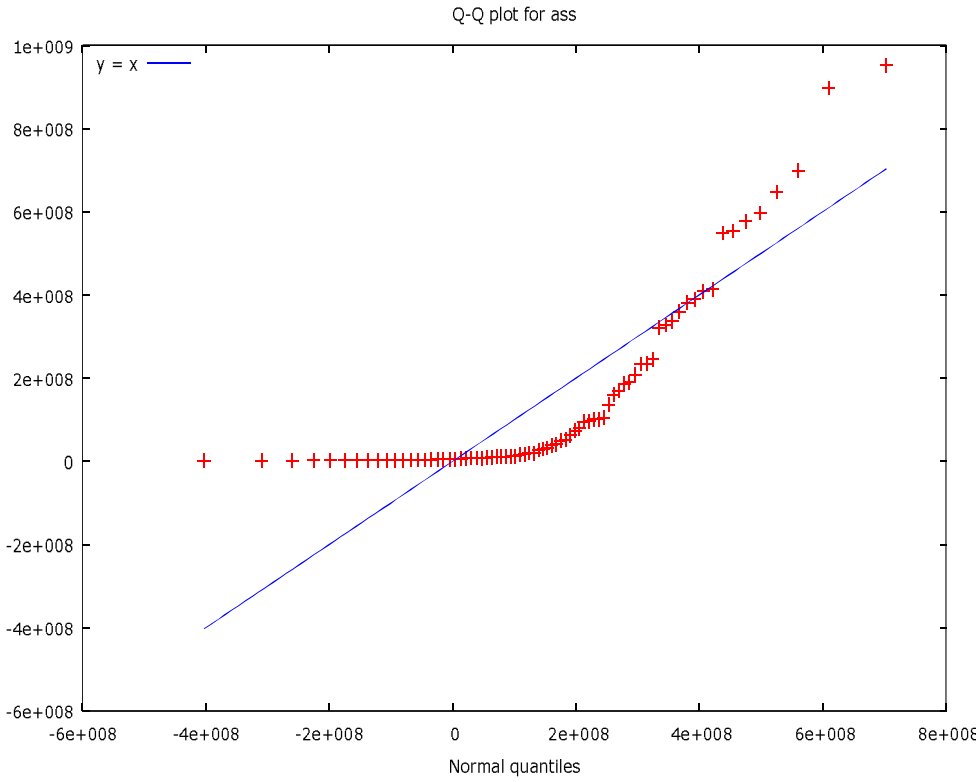

Q-Q plot for l_p30
y = x
4
2
0
-2
-4
-6
-8
-10
-10
-8
-6
-4
-2
0
2
4
Normal quantiles

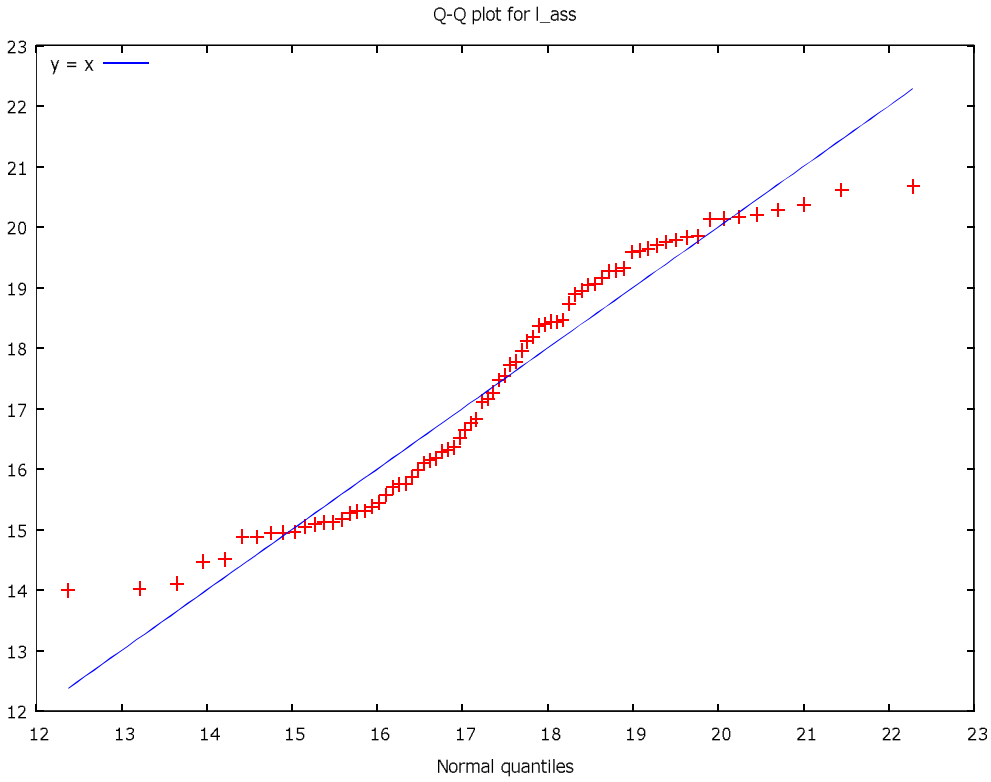

Q-Q plot for pea
y = x
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Normal quantiles


Q-Q plot for l_pea
y = x
-2.2
-2.4
-2.6
-2.8
-3
-3.2
-3.4
-3.6
-3.8
-4
-4.2
-4.2
-4
-3.8
-3.6
-3.4
-3.2
-3
-2.8
-2.6
-2.4
-2.2
Normal quantiles


Q-Q plot for pea
y = x
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Normal quantiles


Q-Q plot for l_pea
y = x
-2.2
-2.4
-2.6
-2.8
-3
-3.2
-3.4
-3.6
-3.8
-4
-4.2
-4.2
-4
-3.8
-3.6
-3.4
-3.2
-3
-2.8
-2.6
-2.4
-2.2
Normal quantiles


Q-Q plot for ass
y = x
1e+009
8e+008
6e+008
4e+008
2e+008
0
-2e+008
-4e+008
-6e+008
-6e+008
-4e+008
-2e+008
0
2e+008
4e+008
6e+008
8e+008
Normal quantiles


Q-Q plot for l_ass
y = x
23
22
21
20
19
18
17
16
15
14
13
12
12
13
14
15
16
17
18
19
20
21
22
23
Normal quantiles

APPENDIX (C)

VRIANCE INFLATION FACTOR

TABLE: 1 (FSS)		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	yogp	.711	1.407
	ccta	.692	1.445
	glpta	.643	1.556
	albpb	.555	1.802
	p30	.522	1.916
	pea	.425	2.354
	ass	.474	2.111
	AGE	.424	2.361

TABLE: 2 (OSS)		Tolerance	VIF
	(Constant)		
	Yogp	.711	1.407
	Ccta	.692	1.445
	glpta	.643	1.556
	albpb	.555	1.802
	p30	.522	1.916
	Pea	.425	2.354
	Ass	.474	2.111
	AGE	.424	2.361

TABLE: 2 (OSS)	Tolerance	VIF
(Constant)		
Yogp	.711	1.407
Ccta	.692	1.445
glpta	.643	1.556
albpb	.555	1.802
p30	.522	1.916
Pea	.425	2.354
Ass	.474	2.111
AGE	.424	2.361

TABLE: 3 (P30)	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
yogp	.927	1.079
albpbg	.628	1.593
glpta	.704	1.421
pea	.609	1.642
pofb	.732	1.367
AGE	.437	2.288
ass	.515	1.941

TABLE: 4 (ALBLBG)	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
FSS	.553	1.808
oss	.398	2.515
AGE	.381	2.622
ass	.474	2.110
p30	.573	1.746
ccta	.865	1.155
glpta	.713	1.402

TABLE: 5 (POFB)	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
FSS	.553	1.808
Oss	.398	2.515
AGE	.381	2.622
Ass	.474	2.110
p30	.573	1.746
Ccta	.865	1.155
glpta	.713	1.402

APPENDIX (D)

TABLE: 1

Results of white's general test of Heteroscedasticity of pooled ols model.

WHITE'S HETEROSKEDASTICITY TEST OF POOLED OLS FINANCIAL SELF SUFFICIENCY (FSS) MODEL

Pooled ols regression model

Dependent variable:FSS

White's test for Heteroskedasticity OLS,   ***using 76 observations***
Dependent variable: Financial self sufficiency (FSS)
Independent variable: (yogp), (ccta), (glpta), (l_albpb) , (p30), (pea), (l_ass), (AGE)
Unadjusted R-squared = 0.759858   ***Test statistic: TR^2 = 57.749210,***   ***with p-value = P(Chi-square(44) > 57.749210) = 0.079952***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets l_albpb = average loan balance per borrower(albpb) ,p30 = portfolio at risk (30) days , pea = labour cost to assets, l-ass = size of mfi, (log of Assets) , AGE = age of mfis in years

TABLE: 2

WHITE'S HETEROSKEDASTICITY TEST OF POOLED OLS, OPERATIONAL SELF SUFFICIENCY (OSS) MODEL

Pooled ols regression model

Dependent variable: OPERATIONAL SELF SUFFICIENCY(OSS)

White's test for Heteroskedasticity ols operational self sufficiency (OSS) model, using 76 observations
Dependent variable: Operational self sufficiency (OSS)
Independent variable: (yogp), (ccta), (glpta), (l_albpb) , (p30), (pea), (l_ass), (AGE)
Unadjusted R-squared = 0.942625 ***Test statistic: TR^2 = 71.639525,*** ***with p-value = P(Chi-square(44) > 71.639525) = 0.005290***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets l_albpb = log of average loan balance per borrowerg ,p30 = portfolio at risk (30) days , pea = labour cost to assets, ass = size of mfi,(log of Assets) , AGE = age of mfis in years

TABLE: 3

WHITE'S HETEROSKEDASTICITY TEST OF POOLED OLS, PORTFOLIO AT RISK (P30) MODEL

Pooled ols regression model

Dependent variable: PORTFOLIO AT RISK 30 DAYS(P30)

White's test for Heteroskedasticity pooled ols of portfolio at risk(P30) model, using 76 observations
Dependent variable: PORTFOLIO AT RISK 30 DAYS(P30)
Independent variable: yogp albpbg glpta pea pofb age l_ass
Unadjusted R-squared = 0.709695 ***Test statistic: TR^2 = 53.936850,*** ***with p-value = P(Chi-square(35) > 53.936850) = 0.021372***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Yogp = yield on gross loan portfolio, albpbg = average loan balance per borrower adjusted by GNI per capita (albpbg), glpta = Gross loan portfolio to total assets ratio, pea = labour cost to assets, pofb = Percentage of female borrower, age = age of mfis in years (AGE), l_ass = size of mfi-log Assets

TABLE: 4

WHITE'S HETEROSKEDASTICITY TEST OF POOLED OLS, PERCENTAGE OF FEMALE BORROWERS (POFB) MODEL

Pooled ols regression model

Dependent variable: Percentage of female borrowers (Pofb)

White's test for Heteroskedasticity pooled ols of percentage of female borrowers (pofb) model,   ***using 76 observations***
Dependent variable: percentage of female borrowers (Pofb)
Independent variable: Fss, Oss, age, l_ass, p30, ccta, glpta
Unadjusted R-squared = 0.740659   ***Test statistic: TR^2 = 56.290116,***   ***with p-value = P(Chi-square(35) > 56.290116) = 0.012713***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Yogp = FSS = Financial self sufficiency, OSS = Operational self sufficiency, AGE = age of mfis in years ass = size of mfi, Assets,p30 = portfolio at risk (30) days ccta = capital cost to assets, glpta = gross loan portfolio to total assets

TABLE: 5

WHITE'S HETEROSKEDASTICITY TEST OF POOLED OLS , AVERAGE LOAN BALANCE PER BORROWER ADJUSTED BY GNI PER CAPITA (ALBPBG) MODEL

Pooled ols regression model

Dependent variable: Average loan balance per borrower adjusted by GNI per capita (albpbg)

White's test for Heteroskedasticity pooled ols of average loan balance per borrower adjustedby GNI per capita(albpbg) model,   ***using 76 observations***
Dependent variable: Average loan balace per borrower adjuted by GNI(albpbg)
Independent variable: Fss, Oss, Age, l_ass, p30, ccta, glpta
Unadjusted R-squared = 0.583145   ***Test statistic: TR^2 = 44.318983,***   ***with p-value = P(Chi-square(35) > 44.318983) = 0.134337***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Fss = financial self sufficiency, Oss = Operational self sufficiency, Age = Age of MFIs in years, l_ass = Size of MFIs (log of assets), P30 = portfolio at risk(30) days, ccta = Capital cost to total assets ratio, Glpta = Gross loan portfolio to total assets ratio.

APPENDIX E

TABLE: 1

DISTRIBUTION FREE WALD TEST FOR HETEROSKEDASTICITY OF FIXED EFFECT REGRESSION (FSS) MODEL

Fixed effect regression model

Dependent variable:FSS

Distribution free wald test for Heteroskedasticity of fixed effect regression (FSS)model ,using 76 observations
Dependent variable: Financial self sufficiency(FSS)
Independent variable: (yogp), (ccta), (glpta), (albpb), (p30), (pea), (l_ass), (AGE)
Distribution free Wald test for heteroskedasticity: ***Chi-square(10) = 58.8295, with p-value = 6.03106e-009***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets albpb = average loan balance per borrower (albpb), p30 = portfolio at risk (30) days, pea = labour cost to assets, ass = size of mfi, (Assets) , AGE = age of mfis in years

TABLE: 2

DISTRIBUTION FREE WALD TEST FOR HETEROSKEDASTICITY OF FIXED EFFECT REGRESSION, OPERATIONAL SELF SUFFICIENCY (OSS) MODEL

Fixed effect regression model

Dependent variable:oss

Distribution free wald test for Heteroskedasticity of fixed effect regression, OPERATIONAL SELF SUFFICIENCY(OSS) model ,using 76 observations
Dependent variable: Operational self sufficiency(OSS)
Independent variable: (yogp), (ccta), (glpta), (albpb) , (p30), (pea), (l_ass), (AGE)
Distribution free Wald test for heteroskedasticity: ***Chi-square(10) = 3053.59, with p-value = 0***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets, albpb = average loan balance per borrower, p30 = portfolio at risk (30) days, pea = labour cost to assets, l_ass = size of mfi (log of Assets), AGE = age of mfis in years

TABLE: 3

DISTRIBUTION FREE WALD TEST FOR HETEROSKEDASTICITY OF FIXED EFFECT REGRESSION, PORTFOLIO AT RISK (P30) MODEL

Fixed effect regression model

Dependent variable: P30

Distribution free Wald test for heteroskedasticity:

Fixed effect regression model

Dependent variable: P30

Distribution free wald test for Heteroskedasticity of fixed effect regression,portfolio at risk (30) days (P30) model ,using 76 observations
Dependent variable: Portfolio at risk (p30)
Independent variable: (yogp), (pofb), (glpta), (albpbg), (pea), (l_ass), (AGE)
Distribution free Wald test for heteroskedasticity: ***Chi-square(10) = 3053.59, with p-value = 0***

Source:Gretl output

Notes:Regressors, their squared terms and their cross products are not shown in the table.

Yogp = yield on gross loan portfolio, pofb = percentage of female borrowers glpta = gross loan portfolio to total assets albpbg = average loan balance per borrower adjusted by GNI per capita, p30 = portfolio at risk (30) days , pea = labour cost to assets, l_ass = size of mfi (log of Assets), AGE = age of mfis in years

TABLE: 4

DISTRIBUTION FREE WALD TEST FOR HETEROSKEDASTICITY OF FIXED EFFECT REGRESSION, PERCENTAGE OF FEMALE BORROWERS

Fixed effect regression model

Dependent variable: Percentage of female borrowers (pofb)

Distribution free wald test for Heteroskedasticity of fixed effect regression,Percentage of female borrowers (Pofb) ,using 76 observations
Dependent variable: Percentage of female borrowers(Pofb)
Independent variable: Fss, Oss, Age, l_ass, p30, ccta, glpta
Distribution free Wald test for heteroskedasticity: ***Chi-square(10) = 22713.1, with p-value = 0***

Source: Gretl output

Notes: Regressors, their squared terms and their cross products are not shown in the table.

Fss = financial self sufficiency, Oss = Operational self sufficiency, Age = Age of MFIs in years, l_ass = Size of MFIs (log of assets), P30 = portfolio at risk(30) days, ccta = Capital cost to total assets ratio, Glpta = Gross loan portfolio to total assets ratio.

TABLE: 5

DISTRIBUTION FREE WALD TEST FOR HETEROSKEDASTICITY OF FIXED EFFECT REGRESSION, AVERAGE LOAN BALANCE PER BORROWER ADJUSTED BY GNI PER CAPITA

Fixed effect regression model

Dependent variable: Average loan balance per borrower adjusted by GNI per capita (albpbg)

Distribution free wald test for Heteroskedasticity of fixed effect regression,Average loan balance per borrower adjusted by GNI per capita(albpbg) ,using 76 observations
Dependent variable: Average loan balance per borrower adjusted by GNI per capita(albpbg)
Independent variable: Fss, Oss, Age, l_ass, p30, ccta, glpta
Distribution free Wald test for heteroskedasticity: ***Chi-square(10) = 41.2271, with p-value = 1.0286e-005***

Source: Gretl output

Notes:Regressors, their squared terms and their cross products are not shown in the table.

Fss = financial self sufficiency, Oss = Operational self sufficiency, Age = Age of MFIs in years, l_ass = Size of MFIs (log of assets), P30 = portfolio at risk(30) days, ccta = Capital cost to total assets ratio, Glpta = Gross loan portfolio to total assets ratio.

APPENDIX (F)

TABLE 1

Result of Durbin Watson test in respective models of pooled ols regression technique.

Durbin-Watson test in POOLED OLS (FSS) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: FSS

Independent variable: (yogp), (ccta),(glpta),(l_albpb),(p30), (pea), (l_ass),(AGE)

Mean dependent var	0.657846	S.D. dependent var	0.313578
Sum squared resid	4.532982	S.E. of regression	0.260109
R-squared	0.385346	Adjusted R-squared	0.311955
F(8, 67)	5.250555	P-value(F)	0.000041
Log-likelihood	-0.703899	Akaike criterion	19.40780
Schwarz criterion	40.38440	Hannan-Quinn	27.79106
Rho	0.244006	**Durbin-Watson**	**1.107617**

Source: ***Gretl output***

Notes:*Coefficients, std. errors, t-statistics and probability & significance level of variables are not* shown here.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets l_albpb = log of average loan balance per borrower, p30 = portfolio at risk (30) days , pea = labour cost to assets, l_ass = size of mfi (log of Assets), AGE = age of mfis in years

TABLE 2

Durbin-Watson test in POOLED OLS (OSS) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: OPERATIONAL SELF SUFFICIENCY (OSS)

Independent variable: (yogp), (ccta),(glpta),(l_albpb),(p30), (pea), (l_ass), (AGE)

Mean dependent var	1.019249	S.D. dependent var	0.422616
Sum squared resid	6.089734	S.E. of regression	0.301482
R-squared	0.545384	Adjusted R-squared	0.491102
F(8, 67)	10.04715	P-value(F)	4.42e-09
Log-likelihood	-11.92243	Akaike criterion	41.84486
Schwarz criterion	62.82146	Hannan-Quinn	50.22813
Rho	0.100017	**Durbin-Watson**	**1.532618**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets, l_albpb = log of average loan balance per borrower, p30 = portfolio at risk (30) days, pea = labour cost to assets, l_ass = size of mfi, (log of Assets) , AGE = age of mfis in years

TABLE 3

Durbin-Watson test in POOLED OLS (P30) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: Portfolio at risk (P30)

Independent variable: (yogp), l_albpb), (glpta), (pea), (pofb), (AGE), (l_ass)

Mean dependent var	0.192328	S.D. dependent var	0.320923
Sum squared resid	2.756551	S.E. of regression	0.201339
R-squared	0.643135	Adjusted R-squared	0.606399
F(7, 68)	17.50690	P-value(F)	4.84e-13
Log-likelihood	18.19729	Akaike criterion	-20.39458
Schwarz criterion	-1.748708	Hannan-Quinn	-12.94278
Rho	0.262344	**Durbin-Watson**	**1.319928**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

Yogp = yield on gross loan portfolio, pofb = percentage of female borrowers, glpta = gross loan portfolio to total assets, albpbg = average loan balance per borrower adjusted by GNI per capita, p30 = portfolio at risk (30) days, pea = labour cost to assets, l_ass = size of mfi (log of Assets), AGE = age of mfis in years

TABLE 4

Durbin-Watson test in POOLED OLS (POFB) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: Percentage of female borrowers (POFB)

Independent variable: FSS, Oss, age, l_ass, p30, ccta, glpta

Mean dependent var	0.989755	S.D. dependent var	0.024812
Sum squared resid	0.036100	S.E. of regression	0.023041
R-squared	0.218142	Adjusted R-squared	0.137657
F(7, 68)	2.710337	P-value(F)	0.015390
Log-likelihood	182.9445	Akaike criterion	-349.8890
Schwarz criterion	-331.2431	Hannan-Quinn	-342.4372
Rho	0.842648	**Durbin-Watson**	**0.388353**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

FSS = financial self sufficiency, Oss = Operational self sufficiency, AGE = age of mfis in years, l_ass = size of mfi(log of Assets), P30 = Portfolio at risk, ccta = capital cost to total assets ratio, glpta = Gross loan portfolio to total assets ratio

TABLE 5

Durbin-Watson test in POOLED OLS (ALBPBG) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: Average loan balance per borroweradjusted by GNI

Independent variable: FSS, oss l_age, l_ass, P30, ccta, glpta

Mean dependent var	0.135682	S.D. dependent var	0.037720
Sum squared resid	0.071269	S.E. of regression	0.032374
R-squared	0.332121	Adjusted R-squared	0.263369
F(7, 68)	4.830688	P-value(F)	0.000185
Log-likelihood	157.0979	Akaike criterion	-298.1959
Schwarz criterion	-279.5500	Hannan-Quinn	-290.7441
Rho	0.393973	**Durbin-Watson**	**0.941964**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

FSS = financial self sufficiency, Oss = Operational self sufficiency, AGE = age of mfis in years, l_ass = size of mfi (log of Assets), P30 = Portfolio at risk, ccta = capital cost to total assets ratio, glpta = Gross loan portfolio to total assets ratio

APPENDIX (G)

Result of Durbin Watson test in respective models of fixed effect regression technique.

TABLE 1

Durbin-Watson test in FIXED EFFECT (FSS) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: FSS

Independent variable: (yogp), (ccta), (glpta), (l_albpb), (p30), (pea), (l_ass), (AGE)

Mean dependent var	0.657846	S.D. dependent var	0.313578
Sum squared resid	3.080846	S.E. of regression	0.230474
R-squared	0.582250	Adjusted R-squared	0.459806
F(17, 58)	4.755233	P-value(F)	3.86e-06
Log-likelihood	13.97078	Akaike criterion	8.058447
Schwarz criterion	50.01165	Hannan-Quinn	24.82497
Rho	0.092347	**Durbin-Watson**	**1.437774**

Source: ***Gretl output***

Notes:*Coefficients, std. errors, t-statistics and probability & significance level of variables are not* shown here.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets l_albpb = log of average loan balance per borrower, p30 = portfolio at risk (30) days, pea = labour cost to assets, l_ass = size of mfi, (log of Assets), AGE = age of mfis in years

TABLE 2

Durbin-Watson test in FIXED EFFECT (OSS) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: OPERATIONAL SELF SUFFICIENCY

Independent variable: (yogp), (ccta),(glpta),(l_albpb),(p30), (pea), (l_ass),(AGE)

Mean dependent var	1.019249	S.D. dependent var	0.422616
Sum squared resid	4.086476	S.E. of regression	0.301482
R-squared	0.694933	Adjusted R-squared	0.491102
F(17, 58)	7.771897	P-value(F)	4.42e-09
Log-likelihood	3.236585	Akaike criterion	41.84486
Schwarz criterion	71.48003	Hannan-Quinn	50.22813
Rho	0.100017	**Durbin-Watson**	**1.532618**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets l_albpb = log of average loan balance per borrower, p30 = portfolio at risk (30) days, pea = labour cost to assets, l_ass = size of mfi (log of Assets), AGE = age of mfis in years

TABLE 3

Durbin-Watson test in FIXED EFFECT (P30) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: Portfolio at risk (P30)

Independent variable: (yogp), (albpbg), (glpta), (pea), (pofb), (age), (l_ass)

Mean dependent var	0.192328	S.D. dependent var	0.320923
Sum squared resid	2.529338	S.E. of regression	0.174909
R-squared	0.672550	Adjusted R-squared	0.702953
F(15, 60)	8.215611	P-value(F)	3.66e-13
Log-likelihood	21.46614	Akaike criterion	-34.57441
Schwarz criterion	26.35945	Hannan-Quinn	-18.73935
Rho	0.188226	**Durbin-Watson**	**1.944875**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

Yogp = yield on gross loan portfolio, ccta = capital cost to assets, glpta = gross loan portfolio to total assets l_albpb = log of average loan balance per borrower, p30 = portfolio at risk (30) days, pea = labour cost to assets, l_ass = size of mfi (log of Assets), AGE = age of mfis in years

TABLE 4

Durbin-Watson test in FIXED EFFECT (POFB) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: Percentage of female borrowers (POFB)

Independent variable: FSS, Oss, age, l_ass, p30, ccta, glpta

Mean dependent var	0.989755	S.D. dependent var	0.024812
Sum squared resid	0.011901	S.E. of regression	0.014202
R-squared	0.742245	Adjusted R-squared	0.672346
F(16, 59)	10.61874	P-value(F)	5.34e-12
Log-likelihood	225.1118	Akaike criterion	-416.2235
Schwarz criterion	-376.6010	Hannan-Quinn	-400.3884
Rho	0.348082	**Durbin-Watson**	**1.075426**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

FSS = financial self sufficiency, Oss = Operational self sufficiency, AGE = age of mfis in years, l_ass = size of mfi (log of Assets), P30 = Portfolio at risk, ccta = capital cost to total assets ratio, glpta = Gross loan portfolio to total assets ratio

TABLE 5

Durbin-Watson test in FIXED EFFECT (ALBPBG) regression model, using 76 observations

Included 10 cross-sectional units

Time-series length = minimum 5, maximum 9

Dependent variable: Average loan balance per borrower adjusted by GNI

Independent variable: FSS, oss, age, l_ass, P30, ccta, glpta

Mean dependent var	0.135682	S.D. dependent var	0.037720
Sum squared resid	0.034539	S.E. of regression	0.024195
R-squared	0.676327	Adjusted R-squared	0.588552
F(16, 59)	7.705187	P-value(F)	2.38e-09
Log-likelihood	184.6242	Akaike criterion	-335.2484
Schwarz criterion	-295.6259	Hannan-Quinn	-319.4133
Rho	-0.029142	**Durbin-Watson**	**1.787962**

Source: Gretl output

Notes:Coefficients, std. errors, t-statistics and probability & significance level of variables are not shown here.

FSS = financial self sufficiency, Oss = Operational self sufficiency, AGE = age of mfis in years, l_ass = size of mfi (log of Assets), P30 = Portfolio at risk, ccta = capital cost to total assets ratio, glpta = Gross loan portfolio to total assets ratio

APPENDIX (H)

TABLE 1

Panel diagonostic results for FSS model

Fixed effects estimator

allows for differing intercepts by cross-sectional unit

slope standard errors in parentheses, p-values in brackets

const:	*-0.49938*	*(0.85967)*	*[0.56356]*
yogp:	*0.45135*	*(0.17344)*	*[0.01173]*
ccta:	*-0.476*	*(1.0005)*	*[0.63604]*
glpta:	*0.031057*	*(0.037763)*	*[0.41421]*
l_albpb:	*0.13024*	*(0.17085)*	*[0.44894]*
p30:	*-0.33681*	*(0.1384)*	*[0.01805]*
pea:	*-1.0883*	*(2.8953)*	*[0.70837]*
l_ass:	*0.14599*	*(0.046253)*	*[0.00253]*
l_AGE:	*-0.73137*	*(0.27563)*	*[0.01026]*

10 group means were subtracted from the data

Residual variance: 3.08085/(76 - 18) = 0.053118

Joint significance of differing group means:

F(9, 58) = 3.03754 with p-value 0.00482595

(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.)

Means of pooled OLS residuals for cross-sectional units:

unit 1: -0.043571

unit 2: -0.076075

unit 3: 0.04914

unit 4: 0.040295

unit 5: -0.095159

unit 6: -0.11469

unit 7: 0.023676

unit 8: -0.077785

unit 9: 0.0028709

unit 10: 0.2755

Breusch-Pagan test statistic:

LM = 2.18756 with p-value = prob(chi-square(1) > 2.18756) = 0.139129

(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.)

Variance estimators:

between = 0.019306

within = 0.053118

Panel is unbalanced: theta varies across units

Random effects estimator

allows for a unit-specific component to the error term

(standard errors in parentheses, p-values in brackets)

const:	***-0.17219***	***(0.78016)***	***[0.82599]***
yogp:	***0.5418***	***(0.17468)***	***[0.00282]***
ccta:	***-0.71581***	***(0.69331)***	***[0.30557]***
glpta:	***-0.0012684***	***(0.036777)***	***[0.97259]***
l_albpb:	***0.21212***	***(0.15485)***	***[0.17529]***
p30:	***-0.37047***	***(0.12368)***	***[0.00384]***
pea:	***-0.73601***	***(2.7095)***	***[0.78674]***
l_ass:	***0.060339***	***(0.029808)***	***[0.04693]***
l_AGE:	***-0.43893***	***(0.15017)***	***[0.00473]***

Hausman test statistic:

H = 16.5078 with p-value = prob(chi-square(8) > 16.5078) = 0.0356629

(A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.)

Fixed effects estimator

allows for differing intercepts by cross-sectional unit

slope standard errors in parentheses, p-values in brackets

const:	***0.82166***	***(0.99008)***	***[0.41000]***
yogp:	***0.8302***	***(0.19975)***	***[0.00011]***
ccta:	***3.4996***	***(1.1523)***	***[0.00358]***
glpta:	***0.018861***	***(0.043492)***	***[0.66614]***
l_albpb:	***0.45711***	***(0.19676)***	***[0.02370]***
p30:	***-0.72011***	***(0.15939)***	***[0.00003]***
pea:	***-6.0306***	***(3.3345)***	***[0.07571]***
l_ass:	***0.098778***	***(0.05327)***	***[0.06878]***
l_AGE:	***-1.3938***	***(0.31745)***	***[0.00005]***

10 group means were subtracted from the data

Residual variance: 4.08648/(76 - 18) = 0.0704565

Joint significance of differing group means:

F (9, 58) = 3.15917 with p-value 0.00362161

(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.)

TABLE 2

Result of panel diagonostic test for OSS model

Means of pooled OLS residuals for cross-sectional units:

unit 1: -0.061311

unit 2: -0.096857

unit 3: -0.086392

unit 4: 0.16607

unit 5: 0.10177

unit 6: 0.13207

unit 7: -0.015801

unit 8: -0.13653

unit 9: -0.03546

unit 10: -0.023738

Breusch-Pagan test statistic:

LM = 0.0031498 with p-value = prob(chi-square(1) > 0.0031498) = 0.955244

(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.)

Variance estimators:
between = 0.00879782
within = 0.0704565
Panel is unbalanced: theta varies across units

Random effects estimator
allows for a unit-specific component to the error term
(standard errors in parentheses, p-values in brackets)

const:	*0.52569*	*(0.92824)*	*[0.57306]*
yogp:	*0.81779*	*(0.21296)*	*[0.00028]*
ccta:	*-0.3942*	*(0.75279)*	*[0.60225]*
glpta:	*-0.022795*	*(0.044819)*	*[0.61271]*
l_albpb:	*0.18985*	*(0.18676)*	*[0.31303]*
p30:	*-0.90257*	*(0.14718)*	*[0.00000]*
pea:	*-3.5025*	*(3.1656)*	*[0.27250]*
l_ass:	*0.036272*	*(0.027468)*	*[0.19116]*
l_AGE:	*-0.29106*	*(0.13937)*	*[0.04057]*

Hausman test statistic:
H = 35.2813 with p-value = prob(chi-square(8) > 35.2813) = 2.3761e-005
(A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.)

TABLE 3
Result of panel diagonostic test for P30 model

Fixed effects estimator
allows for differing intercepts by cross-sectional unit
slope standard errors in parentheses, p-values in brackets

const:	*-0.72662*	*(0.68949)*	*[0.29618]*
yogp:	*0.48267*	*(0.14362)*	*[0.00136]*
albpbg:	*-3.044*	*(1.0463)*	*[0.00507]*
glpta:	*0.055907*	*(0.032363)*	*[0.08922]*
pea:	*-7.8393*	*(2.2033)*	*[0.00074]*
l_AGE:	*0.46031*	*(0.22756)*	*[0.04756]*
l_ass:	*0.020516*	*(0.03957)*	*[0.60604]*

10 group means were subtracted from the data

Residual variance: 2.52934/(76 - 16) = 0.0421556
Joint significance of differing group means:
F(9, 60) = 1.49967 with p-value 0.168956
(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.)

Means of pooled OLS residuals for cross-sectional units:

unit 1: 0.064399
unit 2: 0.037407
unit 3: -0.096149
unit 4: -0.029722
unit 5: -0.088394
unit 6: 0.061221
unit 7: -0.067339
unit 8: 0.021393
unit 9: -0.015687
unit 10: 0.094726

Breusch-Pagan test statistic:
LM = 0.0829363 with p-value = prob(chi-square(1) > 0.0829363) = 0.773357
(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.)

Variance estimators:

between = 0.00168569

within = 0.0421556

Panel is unbalanced: theta varies across units

Random effects estimator

allows for a unit-specific component to the error term

(standard errors in parentheses, p-values in brackets)

const:	*0.62063*	*(0.28526)*	*[0.03301]*
yogp:	*0.64061*	*(0.13187)*	*[0.00001]*
albpbg:	*-4.0082*	*(0.79528)*	*[0.00000]*
glpta:	*0.069737*	*(0.029564)*	*[0.02117]*
pea:	*-9.9801*	*(1.8539)*	*[0.00000]*
l_AGE:	*0.14121*	*(0.094943)*	*[0.14149]*
l_ass:	*0.003501*	*(0.018246)*	*[0.84841]*

Hausman test statistic:

H = 15.8668 with p-value = prob(chi-square(6) > 15.8668) = 0.0144873

(A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.)

TABLE 4

Results of Panel diagonostic test for POFB model

Fixed effects estimator

allows for differing intercepts by cross-sectional unit

slope standard errors in parentheses, p-values in brackets

const:	*1.0361*	*(0.044791)*	*[0.00000]*
FSS:	*-0.0047359*	*(0.009588)*	*[0.62318]*
oss:	*0.016055*	*(0.0072887)*	*[0.03153]*
l_AGE:	*0.036751*	*(0.017718)*	*[0.04243]*
l_ass:	*-0.0084572*	*(0.0028615)*	*[0.00448]*
p30:	*-0.014855*	*(0.0084112)*	*[0.08255]*
ccta:	*-0.050211*	*(0.05473)*	*[0.36266]*
glpta:	*-0.0044543*	*(0.0022069)*	*[0.04811]*

10 group means were subtracted from the data

Residual variance: 0.0119009/(76 - 17) = 0.000201711

Joint significance of differing group means:

F(9, 59) = 13.3297 with p-value 2.45391e-011

(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.)

Means of pooled OLS residuals for cross-sectional units:

unit 1: 0.015904

unit 2: 0.014603

unit 3: 0.013672

unit 4: -0.03838

unit 5: 0.007716

unit 6: -0.0048633

unit 7: -0.010757

unit 8: -0.0041536

unit 9: -0.006093

unit 10: 0.0045109

Breusch-Pagan test statistic:

LM = 91.5443 with p-value = prob(chi-square(1) > 91.5443) = 1.09119e-021

(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.)

Variance estimators:

between = 2.42583e-005

within = 0.000201711

Panel is unbalanced: theta varies across units

Random effects estimator

allows for a unit-specific component to the error term

(standard errors in parentheses, p-values in brackets)

const:	*1.0531*	*(0.030889)*	*[0.00000]*
FSS:	*0.0067678*	*(0.011328)*	*[0.55219]*
oss:	*-0.0063725*	*(0.0097131)*	*[0.51399]*
l_AGE:	*-0.011101*	*(0.010653)*	*[0.30105]*
l_ass:	*-0.00142*	*(0.0019918)*	*[0.47835]*
p30:	*-0.018996*	*(0.01107)*	*[0.09073]*
ccta:	*0.012661*	*(0.051024)*	*[0.80477]*
glpta:	*-0.0037971*	*(0.0032309)*	*[0.24399]*

Hausman test statistic:

H = 148.296 with p-value = prob(chi-square(7) > 148.296) = 9.25335e-029

(A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.)

TABLE 5

Results of Panel diagonostic test for ALBPB model

Fixed effect estimator

allows for differing intercepts by cross-sectional unit

slope standard errors in parentheses, p-values in brackets

const:	*0.1148*	*(0.076306)*	*[0.13779]*
FSS:	*-0.0038291*	*(0.016334)*	*[0.81546]*
oss:	*0.035557*	*(0.012417)*	*[0.00579]*
l_AGE:	*-0.032555*	*(0.030184)*	*[0.28518]*
l_ass:	*0.005757*	*(0.0048747)*	*[0.24235]*
p30:	*-0.015513*	*(0.014329)*	*[0.28340]*
ccta:	*-0.34758*	*(0.093237)*	*[0.00043]*
glpta:	*0.0017489*	*(0.0037597)*	*[0.64353]*

10 group means were subtracted from the data

Residual variance: 0.0345387/(76 - 17) = 0.000585401

Joint significance of differing group means:

F(9, 59) = 6.97145 with p-value 8.90219e-007

(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.)

Means of pooled OLS residuals for cross-sectional units:

unit 1: 0.017948
unit 2: 0.004125
unit 3: -0.014292
unit 4: 0.0033749
unit 5: -0.021596
unit 6: -0.016787
unit 7: 0.047776
unit 8: 0.026994
unit 9: -0.018337
unit 10: -0.0071453

Breusch-Pagan test statistic:
LM = 13.6101 with p-value = prob(chi-square(1) > 13.6101) = 0.000224975
(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.)

Variance estimators:
between = 0.00151538
within = 0.000585401
Panel is unbalanced: theta varies across units

Random effects estimator
allows for a unit-specific component to the error term
(standard errors in parentheses, p-values in brackets)

const:	***0.16159***	***(0.061785)***	***[0.01097]***
FSS:	***0.0029402***	***(0.015418)***	***[0.84933]***
oss:	***0.031891***	***(0.01173)***	***[0.00831]***
l_AGE:	***-0.031281***	***(0.024443)***	***[0.20497]***
l_ass:	***0.0028763***	***(0.0042925)***	***[0.50509]***
p30:	***-0.014934***	***(0.013522)***	***[0.27331]***
ccta:	***-0.29678***	***(0.079795)***	***[0.00041]***
glpta:	***0.00089616***	***(0.003628)***	***[0.80564]***

Hausman test statistic:

H = 5.98365 with p-value = prob(chi-square(7) > 5.98365) = 0.54166

(A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.)

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Determinants of Financial Self Sufficiency of Andhra Pradesh Microfinance Institutions

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Abstract

Microfinance aims to reduce poverty and generate profit by providing financial services to poor and unprivileged section of society. The southern state of Andhra Pradesh in India which is known as Mecca of Microfinance accounts for about 30% of the credit extended by MFIs. Andhra Pradesh Microfinance Crisis 2010 lead to the shutdown of many emerging and small MFIs and loss of loan portfolio rose to the extent of Rs 7,200 crore. Financial sustainability became very challenging issue for Microfinance institutions. This study uses cross sectional high quality panel data from MIX (Microfinance Information Exchange) market of 10 microfinance institutions of Andhra Pradesh, for the period 2005 to 2013 to examine the patterns of financial viability. This study employed pooled OLS model, fixed effect model and Random effect model of panel data in order to check consistency of results.

Keywords: Financial sustainability; Microfinance institutions; Microfinance crisis

Introduction and Issues

Microfinance institutions (MFIs) have proved to be very important in growth and development of a country. MFIs enhance financial deepening in an economy thereby contributing to an economy's development by providing financial services to the extremely poor section of society. Nowadays, MFIs face challenge of sustainability and outreach. There has been increased pressure on MFIs to decrease dependence on donations, grants and subsidized funding. As providing Microfinance services is a costly business due to high transaction and information cost. At presents, large number of Microfinance programs is still depending on donors, grants and donations which mean that MFIs are not financially sustainable. In 1990s, the issue of sustainability of MFIs gave rise to important debate between financial system approach and poverty lending approach (Robinson, 2001) [1].

According to the report of Deutsche bank (2007) only 1-2% of MFIs in the world are financially sustainable [2]. 8% of all MFIs are close to being profitable. 70% of all MFIs are heavily dependent on subsidy. Microfinance in India has grown at tremendous pace in recent years, achieving significant outreach amongst the poor household across the country. According to the status of Microfinance report 2011-12 there are about 1,000 MFIs in country working in various legal forms, Puhazhendhi [3]. The southern state of Andhra Pradesh accounts for about 30% of the credit extended by MFIs. According to the article published in, "Business Standard" the number of Self-help groups is declining over the years an indication of weakening SHG movement in India. NABARD has also raised alarm over rising Non Performing Assets (NPAs) or Bad loans in SHG bank linkage model. Andhra Pradesh Microfinance crisis lead to the following repercussions that Non Performing Assets (NPAs) of Andhra's MFIs is an all time high of over 96% in the year 2011. Smaller emerging MFIs shut down their business operations and loss of MFI portfolio to the extent of Rs. 7,200 crore.

Research objectives

The study is focused on achievement of following objectives.

1. To determine the factors affecting financial sustainability of microfinance institutions in Andhra Pradesh.
2. To analyze the effect of increasing interest rates on Financial Performance of Andhra Pradesh MFIs.

Literature Review

Schafer and Fukasawa in this paper titled "Factors determining operational self sufficiency among Microfinance institutions" investigate about the factors affecting operational self sufficiency of MFIs [4]. The empirical investigation is based on the data of 1,000 MFIs retrieved from MIX market for the year 2006 and 2008 scattered in different part of the world. Their empirical findings by multiple regression analysis revealed that number of borrowers, write off ratio were found to be important determinants of operational self sufficiency. Moreover, there was no significant difference in 2006 before the worldwide financial crisis and in 2008.

Zerai and Rani examined technical efficiency of Ethiopian micro finance institution (MFIs) by utilizing data of 19 micro finance institutions taken from mix market with the help of stochastic frontier analysis [5]. The findings of the study revealed that average efficiency score of 71.72% of Ethiopian MFIs. Assets, operational sustainability, depth of outreach have significant impact on efficiency. The empirical findings confirm tradeoff between efficiency and outreach of Ethiopian MFIs.

Cull, Demirgüc-Kunt and Morduch examines by using dataset of 245 microfinance Institution effect of prudential supervision on MFI profitably outreach to small scale borrowers and women [6]. Their finding suggest that profit oriented micro finance institution respond to supervision by maintaining profit rates and but at the cost outreach to women and poor client that are costly to reach. Their empirical finding shows that supervision has a negative effect on outreach, because supervision is positively related with average loan balance while it is negatively related with the percentage of women borrowers.

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Gutiérrez-Nieto, Serrano-Cinca and Molinero in their paper discussed about dual performance of MFIs i.e social and performance [7]. Out of data set of 450 institutions for the year 2003 from mix microfinance information exchange only 89 MFIs were selected for which complete information was available. Data elopement analysis (DEA) was used to calculate the social and financial efficiency of MFIs. Operating cost and assets gross loan portfolio used as inputs. Gross loan portfolio and financial revenue are used as outputs for measuring financial efficiency. No. of active borrowers and indicator of benefit to the poorest are used as output variable to calculate social efficiency. The result of financial efficiency and social efficiency was correlated with various financial ratios to withdraw the result and interpretation. The findings of this paper suggest that except one, no MFIs are socially efficient but financially efficient MFIs exist. There is low positive relationship between social and financial efficiency of MFIs.

Tehulu used unbalanced panel data from 2004 to 2009 of 23 microfinance institutions in east Africa to identify the factors affecting financial sustainability. The study used binary probit and ordinary probit regression models to identify the factors. The empirical result regression revealed that management efficiency and portfolio at risk is negative and significantly related with financial sustainability. Management inefficiency, portfolio at risk, loan intensity and size are important factors of financial sustainability [8].

Gonzalez examined the technical efficiency of micro finance institution by using DEA and also identify differences in efficiency with the help of Tobit regression average loan size, proportion of assets used as performing portfolio, scale of operation, ratio of payroll to expenses, age, structure of the board and for profit status of MFIs are the indicators used to determine differences in efficiency [9]. The empirical evidence shows tradeoff between sustainability and outreach in Mexican MFIs. Moreover, this study provides an idea how to use tools to analyze the relative technical efficiency of MFIs.

Rai in his research work "A comparative analysis of the financial performance of micro finance institution of India and Bangladesh" analyzed the financial performance of Indian MFIs and compared it with MFIs of Bangladesh from different point of view by using various performance indicators and Ratios [10]. Mann Whitney U test is used to compare financial performance of India and Bangladesh MFIs. Kruskal Wallis one way ANOVA is used to analyze age wise performance of Indian MFIs after categorizing MFIs into young, mature and old. This study covers the period of 2007-08. There is no significant difference between the means of Bangladesh and Indian MFIs on operational self sufficiency, yield on gross loan portfolio and return on assets. NBFC MFIs are financially more viable and outreach is high.

Masood and Ahmad measured the technical efficiency of micro finance institution by applying stochastic frontier approach of unbalanced panel data of 40 micro finance institutions withdrawn from mix market for the period 2005-08 [11]. The objective of the study is to benchmark the best practice MFIs by assigning ranks and to determine the factors responsible for variation in efficiency level. The findings of the study revealed that efficiency level of micro finance institution is very low and it is increasing during the study period and there is no evidence of trade off. MFIs in southern part of India are more efficient than other MFIs. Moreover unregulated MFIs are more efficient than regulated MFIs.

Gutierrez et al. employed data envelopment analysis (DEA) approach to efficiency to prove that ratio analysis does not capture DEA efficiency. This study highlights an important aspect that, "how DEA model be specified i.e. which input and output variables should be chosen [12]. A methodological approach based on multivariate analyses is applied in order to choose appropriate model specifications and to produce ranking of MFIs in terms of efficiency. The finding of the study is based on data obtained data of 30 MFIs from micro rate web page from the year 2003. The selection of inputs and outputs indicators is based on Yaron's (1994) outreach and sustainability framework. The study reveals that level of MFIs depend on the particular model. This model is also relevant for efficiency assessment.

Hassan and Sanchez investigates about the technical and scale efficiency of MFIs by using Data elopement analysis. The data of 215 MFIs was taken from mix (A CGAP data base of MFIs around the globe). These MFIs are scattered in region of Latin America, Middle East and North Africa and South Asia. The efficiency of MFIs is analysed following both production approach and intermediation approach. The inputs indicators for the intermediation approach are operating expenses, total financial expenses and labour. The indicators used as output in intermediation approach are gross loan portfolio, total funds and financial revenues. On the other hand, operating expenses and labour are used as input in production approach and Numbers of active borrower is as only input. The empirical findings of the study depicts that technical efficiency is higher for formal MFIs. South Asian MFIs have higher efficiencies in comparison to latin America and middle east and north African MFIs. The efficiencies are of pure technical nature i.e. MFIs are wasting their resources and not producing enough outputs [13].

Data and Methodology

The empirical findings of the study are based on the financial data of Microfinance institutions withdrawn from MIX market (Microfinance Information Exchange database). Mix market provides information about historical and social performance information data of more than 2100 microfinance institutions worldwide serving about 94 million clients. The study is based on the unbalanced panel data consists of 10 Microfinance institutions representing over the period 2005 to 2013 with total 76 observations. As of 31st March 2013 around 200 Indian Microfinance institutions reported data to the MIX. Out of 18 Andhra's Microfinance institutions 10 have been selected for this study. The criteria for selecting the MFIs were based on the time period of 9 years (2005-2013). However data provide by these institutions was incomplete. We have selected those institutions which report at least 5 years data from the period 2005 to 2013 to MIX database. On the basis of this criterion 10 MFIs have been selected. Therefore on the basis of sample size and time period our data is unbalanced panel data with 76 observations.

After fulfilling the above criteria, the unbalanced panel data of 10 microfinance institutions for 9 years period 2005 to 2013 is used for analysis and interpretation. These microfinance institutions are representative of around of around 55% of total number microfinance institutions in Andhra Pradesh given their size and age. It has been attempted to include all categories of size (large, medium and small) and age (old, medium and young) MFIs.

Sampling technique

The purposive sampling technique on the basis of following points given below is adopted. Only those MFIs which follow the followings assumptions are selected for the present study.

1. Only those MFIs which report data to the MIX market

(Microfinance information exchange) of Andhra Pradesh are taken into consideration for this study.

2. Out of the 18 Andhra MFIs which report data to the MIX 10 MFIs have been selected. Only those MFIs which are operating during the period 2005-2013 are selected.
3. Only those MFIs which report at least five years data during the period 2005-2013 is selected for the present study.
4. MFIs do not provide full information regarding the variables. Some observations are missing in the data.
5. After fulfilling the above criteria, the unbalanced panel data of ten firms for nine years during the period (2005 to 2013) are taken into consideration.

The use of panel data enhances tracking variables changes in measured variables and relationship overtime [14]. It allows us to control for unobserved characteristics of individuals cases or MFIs and facilitates causal inferences in situations where inferring causality would be very difficult in case if we had only single year cross sectional data. According to Gujarati, by studying repeated cross sectional data of same cases or firms, Panel data is considered better to study dynamic changes [15]. Furthermore, panel or longitudinal data help us to study the importance of lags in the behavior. We used the pooled OLS model, fixed effect model and random effect model of panel data. However, we try to check the consistency of results by using all the three models independently. Finally Gretl version 1.9.12 software is used to generate regression results and panel diagnostics command in Gretl to determine most appropriate model. On the basis of result of F test, Hausman test and Breusch pagan test most appropriate model is determined and finally our result and interpretation is based on most appropriate model.

Dependent and independent variables

This section states about definitions of independent variables and their expected hypothesis sign related to factors affecting financial sufficiency model. Hypotheses of the study, In line with the main objective of the study, the researcher have developed the following hypotheses based on the theories and empirical studies discussed in literature related to financial self sufficiency.

Dependent variable

Financial self sufficiency (FSS): The key dependent variable in our analysis of profitability is the financial self sufficiency (FSS) ratio, a measure of an institution's ability to generate sufficient revenue to cover its costs. Values below one indicate that it is not doing so. The financial self sufficiency ratio is the best measures of financial performance because the data readjusted as described below and because it offers a more complete summary of inputs and outputs than standard financial ratios such as return on assets or equity.

FSS=Operating Income (Loans+Investments) Operating Costs+Loan Loss Provisions+Financing Costs+Adjusted Cost of Capital

Independent variables and expected hypothesis

Real gross portfolio yield: Portfolio yield is a percentage that shows the institutions ability to generate revenue to covers its Financial and operational expenses. It represents the average gross returns as a proportion of portfolio outstanding. It shows the amount received from interest payments during the period by Microfinance institutions. In case the MFIs following cash accounting system the portfolio yield will not include (interest and fee) income generated by delinquent loan. It indicates the efficiency of micro finance institution in generating cash revenue from their outstanding loan portfolio. In simple words Portfolio Yield shows how much on average the MFIs receives in interest payment on its loan. It is a good indicator of delinquency as if Portfolio at risk is low (as reported by MFI) if the yield is lesser than expected than there is delinquency [16].

The study of indicates the coefficient for gross loan portfolio yield is positive and significant with all three measures of financial performance (financial self sufficiency, operational self sufficiency and return on assets indicating that individual based lenders earns more profit than their average interest are higher [17]. However the result is quite different for village banks or solidarity lenders. For Group lenders and solidarity lenders there is not significant relationship between interest rates and profitability even after controlling for cost? Rahman and Mazlan empirical findings revealed significant and positive relationship between yield on gross loan portfolio and financial self sufficiency [18]. The study of De Crombrugghe et al. founds the gross portfolio yields affects the financial self sufficiency [19]. The finding of the study show financial self sufficiency is positive through interest and fees revenues. The study of Woller and Schreiner shows that real portfolio yield is statistically significant determinant of financial self sufficiency [20]. Adongo and stork found that all the financial institutions during the selected period were financially unsustainable [21]. The study suggests that they were not charging enough interest rates that can cover all financial costs and non-financial costs and risk of their operation. The study of Cull et al. shows that interest rates are related with improved financial performance for individual lenders only [17]. Nyamsogoro empirical findings revealed positive relationship between yield on gross loan portfolio and financial self sufficiency [22]. Hence, based on the earlier empirical evidences, the following hypothesis is framed.

H_1: There exists a positive relationship between yield on gross loan portfolio and financial self sufficiency.

Capital cost to total assets ratio: The capital cost to total assets ratio is used as standard inverse proxy of leverage, especially in banking research because regulatory attentions are paid to capital assets ratio [23]. In context of financial performance agency costs hypothesis states that increasing leverage or decreasing capital assets ratio is associated with reduction in agency cost of outside equity and improvement in financial performance. Kar concludes that reduction in capital cost ratio may raise efficiency [24]. Gebremichael predicted positive relation between capital assets ratio and financial self sufficiency [25]. Accordingly the following hypothesis is predicted.

H_2: There exists a negative relationship between capital cost to assets and financial self sufficiency.

Gross loan portfolio to total assets ratio: Gross loan portfolio to total assets ratio is an indicator of financing structure. It is the ratio of adjusted gross loan portfolio to adjusted total assets. It is an indication of their focus of lending as otherwise these funds could have been utilized for some income generating purpose. Tehulu also predicted that loan intensity affects positively to financial sustainability and his findings show that the coefficient of gross loan portfolio to total assets ratio is positive and significant at 5% level [8]. Cull et al. empirical findings revealed positive relationship between gross loan portfolio to total assets ratio and financial sufficiency [26]. Kar also expected uncertain relationship between gross loan portfolio and financial self sufficiency [24]. However, based on the prior empirical evidence, we

predict positive relationship between financial performance and gross loan portfolio to total assets ratio. Accordingly, the following hypothesis is suggested

H_3: There exists positive relationship between gross loan portfolio to total assets ratio and financial self sufficiency.

Average loan balance per borrower: Average loan size is taken as proxy for depth of outreach. It measures the efficiency of microfinance institutions in selling loans. It is calculated by dividing average gross loan portfolio by number of active borrowers. The size of loan can affect FSS and even portfolio at risk. However, larger loans may be more risky than smaller loans, but their cost per rupee is assumed to be small, if there is some fixed cost per loan. The size of the loan is often taken as indicator of coverage i.e. ability of MFIs to reach poor, as poor people are expected to avail for smaller loan than larger amount of loan. It is interesting to determine how important the effect of the size of the loan and to determine how MFIs perform for given loan size. The findings of the study of Gonzalez shows that larger loans are associated with higher cost efficiency and thereby profitability [9]. However the findings of Cull et al. are against the findings of above two studies [26]. The study revealed that the Micro banks or MFIs which provide smaller loans are not less profitable than those which provide bigger loan. The findings of the study revealed that the average loan sizes are not strongly associated with financial performance indicators. Institutions which provide larger loans are not less profitable than which provide bigger loan amount. Woller and Schreiner found that the depth of outreach is inversely related with financial self sufficiency [20]. Nyamsogoro study also indicates that average loan size is positively and significantly related with financial self sufficiency [22]. Adongo and Stork found that profitability is related with bigger or wealthier loan size per borrower [21]. Therefore, based on the review of prior empirical and theoretical evidences the following hypothesis is suggested.

H_4: There exists a positive relationship between average loan balance per borrower and financial self sufficiency.

Portfolio at risk (30 days): Portfolio at risk indicates that how much an MFI is efficient in making collections of loans. Higher PAR indicates inefficiency of MFIs i.e. indicates lower repayment rates. Lower the PAR the more inefficient the microfinance institutions will be and thereby financially sustainable. Portfolio at risk captures the accounting convention that loans exceeding 30 days overdue pose an unacceptably high risk of non-repayment [24]. He predicted an inverse relationship between PAR (30) and profit efficiency and his findings show negative insignificant relationship between PAR (30) and firm performance. The study of Cull et al. conclude that higher interest rates are associated with higher rates of non-repayment but for individual based lenders only [26]. Moreover, according to one specification individual based lenders charging higher interest rates higher profit than those charging interest intermediate rates. Tehulu also found that credit risk measured by PAR (30) days found to have a negative and significant impact on financial sustainability of MFIs [8]. The empirical findings of Nyamsogoro disclosed that, there is a statistically significant and negative relationship between portfolio at risk and financial sustainability [22]. Thus, in the line with prior studies the following hypothesis is proposed.

H_5: There exists a negative relationship between portfolio at risk and financial self sufficiency.

Personnel productivity ratio: Personnel productivity measures the amount of quality services delivered by microfinance institutions staff to their customers. The finding of the Cull et al. shows that there is negative relationship between charging higher interest rates and having a large customer base. Accordingly, the following hypothesis is suggested [26].

H_6: There exists an uncertain relationship between labour cost to assets and financial self sufficiency.

Size: The size of an MFI is defined as natural logarithm of total assets of the MFIs. Hermes et al. [27]; Mersland and Strom [28]; Bogan, Johnson, and Mhlanga [29]; Hartarska [30] shows that the MFI size do not effects its financial sustainability. While study of Mersland and Strom, Bogan et al., Hartarska used total value of its assets as MFIs size indicator [28-30]. The study of Hartarska shows that the MFIs size did not affect its financial sustainability [30]. While the study of Mersland and Strom, and Bogan et al. revealed that the size of an MFI is associated with its financial sustainability [28,29]. The empirical finding of Cull et al. shows that size of MFI is statistically significant and positively linked to its financial performance [26]. The study of Nyamsogoro found that the size of MFI significantly affects its financial sustainability [22]. Similar findings were also disclosed by the study of Cull et al [26]; Robinson [1]; Bogan et al. [29]; Mersland and Strom [28]. Therefore in the line with prior empirical findings, the following hypothesis is suggested.

H_7: There exists a positive relationship between size of MFIs and financial self sufficiency.

Age of MFIs: The study of Cull et al. revealed that the age of MFIs is significantly and positively related with all three measures of sustainability i.e. (FSS, OSS and ROA) [26]. The study of Gonzalez depicts that the age of Indian MFIs never comes up significant with financial self sufficiency and operational self sufficiency [9]. The findings of Robinson imply that age is significant variable to effect financial self sufficiency [1]. The findings by Nadiya show that relationship between age of MFIs and operational self sufficiency is not significant for determining changes in operational self sufficiency [31]. The study of Bogan et al. shows that the age of MFIs is related to financial sustainability [29]. Nyamsogoro found that age of microfinance institution is not significantly related with financial self sufficiency [22]. Hence, in the line with prior studies the following hypothesis is proposed.

H_8: There exists a positive relationship between age of MFIs and financial self sufficiency (Table 1).

Operational model for financial self sufficiency (FSS)

$$\text{MODEL (FSS)}_{i,t}=\alpha_i+\beta_1(\text{YOGP})_{i,t}+\beta_2\ (\text{CCTA})_{i,t}+\beta_3\ (\text{GLPTA})_{i,t}+\beta_4\ (\text{L\_ALBPB})_{i,t}+\beta5(\text{P30})_{i,t}+\beta_6\ (\text{PEA})_{i,t}+\beta7(\text{L\_ASS})_{i,t}+\beta8\ (\text{AGE})_{i,t}+\varepsilon_{i,t}$$

Where (FSS)=dependent variable {(Financial Self Sufficiency (FSS) in percentage for firm "i" during time period "t")}

α_i=Constant

$\beta_1\ (\text{YOGP})_{i,t}$=coefficient of Independent variable, yield on gross loan portfolio for firm "i" during time period "t"

$\beta_2\ (\text{CCTA})_{i,t}$=coefficient of Independent variable, Capital/Assets ratio for firm "i" during time period "t"

$\beta_3\ (\text{GLPTA})_{i,t}$=coefficient of Independent variable, Gross loan portfolio to total assets ratio for firm "i" during time period "t"

$\beta_4\ (\text{L\_ALBPB})_{i,t}$=coefficient of Independent variable, Average loan balance per borrower for firm "i" during time period "t"

$\beta_5\ (\text{P30})_{i,t}$=coefficient of Independent variable, Portfolio at risk (30) days for firm "i" during time period "t"

β_6 $(PEA)_{i,t}$=coefficient of Independent variable, Labour cost to total Assets ratio for firm "i" during time period "t"

β_7 $(L\_ASS)_{i,t}$=coefficient of Independent variable, Size (log of Total Assets) for firm "i" during time period "t"

β_8 $(AGE)_{i,t}$=coefficient of Independent variable, AGE of MFIs for firm "i" during time period "t"

$\varepsilon_{i,t}$=Error term

Descriptive Statistics

The Table 2 shows the results of descriptive statistics of dependent and independent variables employed in the study. The average loan size is generally used as a measure of depth of outreach. Smaller amount of loan indicates better outreach to poor. The descriptive statistics for mean value of average loan size per borrower is 4.98 in its natural logarithm value. In real term the value for the mean is (149.94$) indicating that MFIs provide (150$) per borrower. The maximum value of loan balance per borrower is (235$) is an indication of serving non poor clients. However the minimum value of (77$) is an indication of better outreach to poor. If FSS value is one or greater than one, it indicates that MFIs are financially self-sustainable. On the other hand less than one indicates that MFIs are not financially self-sustainable. As per the result of descriptive statistics for FSS, the mean value is 0.657 (65.7%) indicates that MFIs in the sample are not financially self-sufficient. The capital cost to assets ratio has an average value of (0.070). It means that around 7% of equity financing is done against total assets by microfinance institutions. Furthermore, the minimum value is 0.0008 and maximum value is 0.365. It indicates that proportion of equity financing is quite low against the total assets.

The result of pair wise correlation is reported in Table 3. The results of correlation analysis show that all the variables except age and (l_ass) are below the threshold limit of (0.7). The result revealed that the variable age is highly correlated with size at (0.73). We further computed variance inflation factor (VIF) for each coefficient to detect the culprit variable causing multicollinearity. The results of VIF values are reported in Appendix Gujarati (2003) and Hair et al. (2006) suggest that variance inflation factor above 10 causes multicollinearity [14,15]. Following the Hair et al. criteria of VIF [14] it is evidence from the result of VIF values of independent variables in all the models ranges from 1 to 3 i.e. within the threshold for nonexistence of multicollinearity. It implies that regression coefficient will be fairly estimating the model.

Results of Financial Self Sufficiency Model by Pooled OLS model, Fixed Effect Model and Random Effect Regression Models

In this section the result of factors affecting financial self sufficiency model is shown by pooled OLS model, random effect model and fixed effect model. In order to check consistency, we employed all the three models of panel data. Finally, our result and interpretation is based on most appropriate model which is chosen on the basis of result of F test to make choice between pooled OLS and fixed effect model, Breusch pagan test to make choice between pooled OLS and random effect model. Finally, Hausman test to make choice between random and fixed effect model.

S/N	Variable Standard Name	Description	Variable description as used in regression	Expected effect on the FSS
1	Real Gross Portfolio Yield	(Yield on gross portfolio (nominal) - Inflation rate)/ (1+Inflation rate)	YOGP	Positive
2	Capital to Assets ratio	Adjusted total equity/Adjusted total assets	CCTA	Negative
3	Gross loan portfolio to total assets ratio	Gross loan portfolio/total assets	GLPTA	Positive
4	Average loan balance per borrower	Adj. GLP/Adj. Number of Active Borrowers	l_ALBPB	Positive
5	Portfolio at risk	The fraction of loan portfolio that is overdue past 30 days or more; that is PAR 30=Portfolio at risk/ Gross loan portfolio	P30	Negative
6	Labour cost to assets	Personnel expenses/total assets	PEA	Positive or negative
7	SIZE OF MFI	The size of MFIs measured by value of its Assets	l_ASS	Positive
8	MFI AGE	Years since its establishment to when evaluation is considered. It also measure length of it outreach.	AGE	Positive

Table 1: Definitions of independent variable and their expected hypothesis sign related to Financial self sufficiency model.

Descriptive statistics of dependent and independent variables					
Variable	**Mean**	**Standard**	**Minimum**	**Maximum**	**No. of observations**
FSS	0.657846	0.313578	0.0360245	1.78001	76
YOGP	0.109191	0.197436	0.1304	0.9954	76
CCTA	0.0705189	0.0574553	0.0008	0.3655	76
GLPTA	1.11314	0.997195	0.6528	8.916	76
p30	0.192328	0.320923	0	0.9954	76
PEA	0.0471257	0.0163077	0.0165	0.0917	76
l_Ass	17.3295	1.99854	13.9942	20.6751	76
AGE	15.5263	5.37767	4	27	76
l_ALBPB	4.9821	0.241976	4.34381	5.45959	76
ALBPB	149.947	35.3323	77	235	76

Note: FSS=financial self sufficiency ratio, YOGP=yield on gross loan portfolio to total assets ratio, CCTA=Capital cost to total assets ratio, GLPTA=gross loan portfolio to total assets ratio, P30=Portfolio at risk (30) days, PEA=Labour cost to total assets ratio, l_ASS=Log of total assets (size), AGE=age of MFIs since its establishment, l_ALBPB=log of average loan balance per borrower, ALBPB=Average loan balance per borrower

Table 2: Descriptive statistics.

Summary of panel data

In this section the coefficients of econometric regressions (pooled, fixed and random) have been summarized to facilitate an overall overview. The Table 4 shows panel data regression for the year 2005-2013 with financial self sufficiency as dependent variable. The table reports summary of pooled OLS, fixed effect and random effect model of financial self sufficiency (FSS) on (GLPTA), yield on gross loan portfolio (YOGP), capital cost to assets (CCTA), gross loan portfolio to total assets (GLPTA), average loan balance per borrower (ALBPB), portfolio at risk (30) days (p30), labour cost to assets (PEA), size of MFI, Assets (ASS), age of MFIs in years (AGE).

Table 4 shows the results from pooled, fixed, and random models. The dependent variable is the financial self sufficiency. According to the result of panel diagnostic command (Result reported in Appendix A and B) fixed effect model is more appropriate and consistent than Pooled OLs and Random effect model. *,**,*** significant at 10%, 5% and 1% level respectively. Figures that are in bold are p values. Figures in parenthesis are t values based on Robust (HAC) standard errors. Figures in brackets are coefficients (Table 4).

This study employed pooled OLS model, fixed effect model and Random effect model of panel data in order to check consistency of results. Though, our results and interpretation is based on most appropriate model which is determined on basis of result of F test, Breusch-pagan test and Hausman test. The result reported in Appendix (B) of panel diagnostic command for FSS model shows that the F statistic value is 3.03 with P value is (0.004) a low p value counts against the null hypothesis that the pooled OLS model is adequate, in favour of the fixed effects alternative. Secondly Breusch-Pagan test is applied on FSS model in order to decide between pooled regression and random effects model. The LM statistic value is 2.18 with P value 0.139. As the P value is much greater than the 5% level of significance. Therefore, our Null hypothesis articulated as pooled regression is more consistent and appropriate than the random effects model remains accepted. Finally the choice between fixed effects and random effects tested through Hausman's specification test. The null hypothesis is framed as random effect is more appropriate and consistent to fixed effects model. The result of Hausman test in Appendix B for FSS model indicates that the low p value of 0.03 is much less than the 5% level of significance. A low p value counts against the random effects model is consistent, in favour of the fixed effect model. Hence, fixed effect is more consistent than the random effects model. The results indicate that fixed effect model is more appropriate than pooled OLS and Random effect model. Therefore results and interpretation for financial self sufficiency (FSS) model is based on the fixed effects model which is discussed in detail in next section.

The explanatory power (R^2) for FSS model is 0.38 in case of pooled OLS model. This reflects that 38% change in FSS model can be explained jointly by the given firm or MFIs specific factors; while the remaining 62% is attributed to the factors outside the model. In case of fixed effect for FSS model explanatory power (R^2) is 0.58 which reflects that 58% changes can be explained by the firm specific determinants, while 42% is attributed to the factors outside the model. Moreover, the value of (R^2) for FSS random effect model is 0.38 reflecting that 38% change in FSS model is due to Firm specific variable and remaining 62% is attributed to the factors outside the model.

Findings and Discussion of Financial Self Sustainability (FSS) Model

Yield on gross loan portfolio

The yield on gross loan portfolio measure of average interest rate on loan to customers is strongly significant and positively associated at 1% significance level in Pooled model. It indicates that increasing interest rates improves financial sustainability of Andhra Microfinance institutions. The econometric result of regression analysis revealed that for one unit increase in a yield on gross loan portfolio financial self-sustainability ratio is expected to increase by 0.66 units, holdings all other variables constant. This suggest that yield on gross loan portfolio is significant variable influencing financial sustainability of microfinance institutions. It also indicates that MFIs tend to be more profitable when interest rates are higher. Finally, it can be concluded that increasing interest rates is clearly associated with improved level of financial self sufficiency. The findings of this study are consistent with that of Nyamsogoro, De Crombrugghe et al. concluded that yield on gross loan portfolio positively affect the financial sustainability of microfinance institutions [19,22]. The findings of the Cull et al. revealed that yield on gross loan portfolio is significant and positively associated across all the measures of financial self-sustainability i.e. Return on Assets, Financial sustainability, Operational self-sustainability for individual based lenders only [26]. The findings of this study are consistent with our findings. Therefore based on regression results, the alternative hypothesis articulated as yield on gross loan portfolio is positively associated with financial self sufficiency is accepted.

Capital cost to assets

The study finds an insignificant negative relationship of capital cost to assets with financial self sufficiency. Therefore on the basis of our

	AGE	CCTA	FSS	GLPTA	L_ALBPBG	L_ASS	P30	PEA	YOGP
AGE	1								
CCTA	-0.3077	1							
FSS	-0.32014	0.035301	1						
GLPTA	0.22275	-0.1773	-0.37808	1					
L_ALBPB	0.053976	0.110357	0.070101	-0.08627	1				
L_ASS	0.732431	-0.33276	-0.05729	-0.07058	0.086663	1			
P30	0.284837	-0.21015	-0.34307	0.457572	0.16452	0.040008	1		
PEA	0.240223	0.212528	0.061753	-0.23289	-0.44092	0.254694	-0.23841	1	
YOGP	0.025384	-0.00825	0.24652	-0.11474	-0.02301	-0.06441	0.322258	0.223271	1

Source: *Gretl output.*

Note: FSS=financial self sufficiency ratio, ALBPBG=Average loan balance per borrower to GNI per capita, YOGP=yield on gross loan portfolio to total assets ratio, CCTA=Capital cost to total assets ratio, GLPTA=gross loan portfolio to total assets ratio, P30=Portfolio at risk (30) days, Pea=Labour cost to total assets ratio, I_ASS=Log of total assets (size), AGE=age of MFIs since its establishment, ALBPB=Average loan balance per borrower

Table 3: Multicollinearity results.

Variables	Pooled OLS regression model	Fixed effect regression model	Random effects regression
Const	(-0.172192)	(-0.499381)	(-0.172192)
	[-0.0643]	[-0.5390]	[-0.2207]
	0.94891	0.59194	0.82599
YOGP	-0.541798	-0.451348	-0.541798
	[3.2606]	[2.3153]	[3.1016]
	0.00175***	0.02415**	0.00282***
CCTA	(-0.71581)	(-0.476002)	(-0.71581)
	[-0.7853]	[-0.5966]	[-1.0325]
	0.43502	0.55311	0.30557
GLPTA	(-0.00126836)	-0.0310568	(-0.00126836)
	[-0.4954]	[0.7628]	[-0.0345]
	0.62196	0.4487	0.97259
l_ALBPB	-0.212125	-0.130244	-0.212125
	[1.2702]	[0.6904]	[1.3699]
	0.2084	0.49269	0.17529
p30	(-0.370474)	(-0.336808)	(-0.370474)
	[-2.0084]	[-2.0049]	[-2.9955]
	0.04864**	0.04965**	0.00384***
PEA	(-0.736011)	(-1.08831)	(-0.736011)
	[-0.0853]	[-0.3375]	[-0.2716]
	0.93225	0.73694	0.78674
l_ASS	-0.0603387	0.145989	-0.0603387
	[0.8008]	[2.8237]	[2.0243]
	0.00125***	0.00650***	0.04693**
AGE	(-0.438934)	(-0.731365)	(-0.438934)
	[5.8795]	[-2.7452]	[-2.9228]
	0.00001***	0.00804***	0.00473***
$_R2$	0.385346	0.58225	0.388844
Adjusted R^2	0.311955	0.459806	0.31587
F-statistic	5.250555	4.755233	5.328531
P – value (F)	0.000041	3.86E-06	0.000035
Durban-Watson	1.427617	1.437774	1.655338

Robust (HAC) standard error,
Included 10 cross-sectional units,
Time-series length: minimum 5, maximum. *,**,*** significant at 10%, 5% and 1% level respectively.

Table 4: Model: Dependent variable: Financial self sufficiency.

result capital cost to assets is insignificant variable influencing financial self sufficiency of Andhra Microfinance institutions. The result of cull et al. indicated that coefficients on the capital cost variables show differences in the way of different type of lenders (Individual, Group and solidarity) generate profits [26]. The findings revealed that, there is no significant difference between capital cost and financial sustainability measure for group lenders. Therefore based on the regression results we reject the alternative hypothesis articulated as there is negative relationship between capital cost to assets and financial self sufficiency.

Gross loan portfolio to total assets

Gross loan portfolio is insignificant predictor in determining financial self sufficiency. The findings shows that Gross loan portfolio to total assets ratio is insignificant variable influencing financial self sufficiency of Andhra Microfinance institutions. However, the findings of cull et al. revealed loan to assets ratio is significant and positively associated with measures of financial sustainability [26]. Therefore based on the regression result the alternative hypothesis is rejected which was formulated as there is positive relationship between gross loan portfolio to total assets and financial self sufficiency.

Log of average loan balance per borrower

The average loan size defined as the average gross loan divided by the number of borrowers. The coefficient is positively associated but insignificant in fixed effect regression model. The result of regression analysis shows that average loan size is not a significant predictor. Therefore, our findings suggest that average loan balance per borrower is not an important factor influencing financial self sufficiency. Our findings are consistent with the findings of cull et al. which indicates that average loan size is not strongly significant with financial sustainability of Microfinance institutions [26]. The study of Nadiya et al. is also against the findings of this study, which shows that operational self sufficiency is significantly and negatively associated to average loan size per borrower [31]. Our findings is also against the findings Gregoire and Tuya, Adongo and stork, Gonzalez, Nyamsogoro which revealed that financial sustainability is significantly and positively linked to average loan size [9,21,22,32]. Therefore, based on the regression result from the study, the alternative hypothesis articulated as there is positive relationship between average balance per borrower and financial self sufficiency is rejected.

Portfolio at risk (30) days

The portfolio at risk measures indicates how much a Microfinance institutions is efficient in making collections of loans. The higher the portfolio at risk indicates lower repayment rates, an indication of inefficient MFI. In simple words, a high portfolio at risk ratio would limit the income derived from Microfinance operations and therefore amount of lendable funds reduces. This would result in rationing of credit and ultimately the continuous supply of quality loan services would be affected and have a negative impact on financial sustainability of MFIs. The result of regression analysis revealed that the coefficient is significant at 5% level and negatively associated with financial self sufficiency. It indicates that Less efficient the MFIs are (higher par) ultimately less will be its financial sustainability. The result of regression analysis confirms the alternative hypothesis that significant reduction in portfolio at risk (30) days should have a positive impact on financial sustainability of MFIs i.e. portfolio at risk is expected to be negatively associated with financial sufficiency. Our findings are consistent with prior empirical findings of Nyamsogoro, Ayayi and sene shows that, there is negative relationship of portfolio at risk with financial sustainability [22,33].

Labour cost to assets (pea)

Labour cost to assets is insignificant negative predictor in determining financial self sufficiency of Andhra Microfinance institutions. Our findings are contrary to findings of Cull et al, shows that labour cost are associated with improved profitability for individual based lenders [26]. For group based lenders the coefficient on their labour cost variable is negative and significant. The findings of this study show that coefficient is negatively associated but insignificant in Random effect model i.e. most appropriate model as per the result of panel diagnostic. Therefore based on the regression result from the study, we fail to reject the null hypothesis which was formulated as there is no significant relationship between labour cost to assets ratio and financial sustainability.

Size (total assets)

Total Assets is the proxy measure for the size of MFIs. The econometric result of regression analysis revealed that Total Assets is

strongly significant at 1% level and positively associated with financial self sufficiency. It indicates that, MFI size does improve its financial sustainability. It means that a change in the size (total Assets) causes a change in financial sustainability positively. The econometric result revealed that for one unit increase in Size of MFIs, financial self sufficiency ratio is expected to increase by (0.03) units, holdings all other variable constant. The findings of this study are consistent with that of Cull et al. [17,26]. He found that MFIs size is positively and significantly linked to financial self sufficiency. Our findings are also consistent with Bogan et al, Hartarska and Nadolnyak, Coleman and Osie and Robinson [1,29,34,35]. However or findings is contrary to the findings of Hartarska [30]. Thus, the findings support the alternative hypothesis articulated as size of MFIs affects financial sustainability positively.

AGE (log value)

The age of MFI refers to the period; MFI has been in operational since it came into existence. The variable age is expected to be positively related to financial self sufficiency. However, the fixed effect regression model shows that age of MFIs is highly significant at 1% level and negatively associated with financial self sufficiency. It indicates that MFIs age does not improve its financial sustainability. It also means that mature MFIs are not financially sustainable. This result is quite strange because with increasing age MFIs must become efficient. Our findings contradict with the study of cull et al. which shows that MFIs age is significantly and positively related with financial self sufficiency [26]. Our findings also contradict with findings of Nadiya et al and Nyamsogoro which shows that age is not significant factor influencing financial self sufficiency [22,31]. Based on the result of fixed effect regression, the alternative hypothesis articulated as, age of MFIs expected to be positively associated with financial self sufficiency is rejected.

Conclusion

Our findings revealed that the important determinant of financial self-sustainability are yield on gross loan portfolio, portfolio at risk (30) days, size and age. The p values of independent variables are highly significant at 1% level in both model FSS model only portfolio at risk is significant at 5% level in FSS model. However labour cost to assets ratio, average loan balance per borrower, gross loan portfolio to total assets ratio and capital cost to assets ratio are insignificant predictor of financial self sufficiency. The findings of yield on gross loan portfolio are consistent with the study of Nyamsogoro and De Crombrugghe et al. found that yield on gross loan portfolio significantly and positively affects the financial performance [19,22]. The finding of portfolio at risk is consistent with the findings of Nyamsogoro and Ayayi and Sene concluded that there is negative association between portfolio at risk and financial sustainability [22,33]. The findings of yield on gross loan portfolio that increasing interest rates are associated with improved financial performance is consistent with De Crombrugghe et al, Cull et al. and Nyamsogoro [19,22,26]. To be financially sustainable Andhra's MFIs must charge optimum enough interest rates in order to cover not only for operating cost but also for the possible losses as a result of loan default. But, it must be done cautiously considering the impact of increasing loan interest rate on loan repayment and depth of outreach to poor clients (Appendix A).

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